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INVERTEBRATE FAUNA OF THE INTERTIDAL ZONE OF THE TOKARA ISLANDS

VII. ASCIDIANS¹⁾²⁾

(Contributions to Japanese Ascidian Fauna. VII)

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With Plates XVIII-XXXVII and 2 Text-figures

The material of ascidians collected in the Tokara Islands consists of the following 25 species and 2 forms, of which 13 species seem to be new to science and 4 species with asterisk are newly recorded from the Japanese waters. Thus the Tokara collection contributed a big addition to Japanese ascidian fauna.

	Takarazima	Nakanosima
1. <i>Polyclinum tsutsui</i> n. sp.	+	
2. <i>Aplidiopsis tokaraensis</i> n. sp.	r	
3. <i>Amaroucium monotonicum</i> n. sp.	rr	
4. <i>Didemnum</i> (<i>Didemnum</i>) <i>moseleyi</i>	+	+
4a. <i>Didemnum</i> (<i>Didemnum</i>) <i>moseleyi</i> f. <i>granulatum</i> nov.	+	
4b. <i>Didemnum</i> (<i>Didemnum</i>) <i>moseleyi</i> f. <i>punici-color</i> nov.		+
*5. <i>Didemnum</i> (<i>Didemnum</i>) <i>candidum</i>	+	
*6. <i>Didemnum</i> (<i>Didemnum</i>) <i>pulvinum</i> nom. nov.	+	rr
*7. <i>Lissoclinum fragile</i>	rr	
8. <i>Leptoclinum mitsukurii</i>	rr	
9. <i>Leptoclinum midori</i> n. sp.	rr	cc
10. <i>Podoclavella polycitorella</i> n. sp.	+	
11. <i>Eudistoma snakabri</i> n. sp.	r	
12. <i>Eudistoma rubra</i> n. sp.	rr	r
13. <i>Eudistoma tokarae</i> n. sp.	rr	
14. <i>Polycitor proliferus</i>	+	+

1) Scientific Survey of the Tokara Islands, Report No. 8.

2) Contributions from the Seto Marine Biological Laboratory, No. 222.

15. <i>Perophora listeri</i> var. <i>tokarae</i> nov.	rr	
16. <i>Perophora formosana</i>	+	+
17. <i>Ecteinascidia tokaraensis</i> n. sp.	r	
18. <i>Ecteinascidia jacerens</i> n. sp.	rr	
*19. <i>Ascidia aperta</i>	c	
20. <i>Ascidia beta</i> n. sp.		rr
21. <i>Botrylloides violaceum</i>	r	
22. <i>Polycarpa takarazima</i> n. sp.	r	
23. <i>Cnemidocarpa areolata</i>	rr	
24. <i>Styela partita</i>	r	
25. <i>Microcosmus curvus</i> n. sp.	r	r
Number of species	24 species + 1 form	8 species + 1 form

It is needless to say that most of the species listed above are tropical ascidians. The most abundant and impressive species are *Ascidia aperta* of Takarazima and *Leptoclinum midori* of Nakanosima which is, as far as I am aware, the northern-most locality of the tropical ascidians harbouring green zoochlorellae in the colony. There are much more species in Takarazima than in Nakanosima; this fact may be attributable to the degree of the development of the coral reef around the island. It is rather questionable whether the circumstances are more tropical in Takarazima than in Nakanosima so that much more ascidians are reservoired in the former.

1. *Polyclinum tsutsui* n. sp.

(Pl. XVIII, Figs. 1-3; Text-fig. 1)

Many encrusting colonies (Type 127, TK. No. 68) were found aggregated under stones at the western side of Maëgomori in Takarazima, the largest one of which is 20 mm × 15 mm in extent. They are 3-4 mm in thickness and dark brownish in colour. Stellate systems distinct, each consists of 4-12 zooids, most frequently 6-8, and has a round common cloacal aperture at the centre. Large colonies contain up to 9 large and small systems.

Test: Transparent, grayish brown in colour. The surface quite free from foreign matters.

Zooid: Large zooids reach 4.5 mm in length, of which 3.5 mm is for thorax and 1 mm for abdomen. Postabdomen about a half as long as abdomen and protruded from the left side of the intestinal loop posterior to the stomach. Constriction between the thorax and the abdomen and that between the abdomen and the postabdomen are both distinct.

Thorax: Branchial aperture 6-lobed; atrial aperture situated on the level of the peripharyngeal band and margined plainly. Atrial languets well developed, tip acute or truncate and with 4-6 teeth; the latter feature is observable when the languet reaches the common cloacal aperture, while the former feature occurs when the languet falls at a distance from the aperture. About 10 longitudinal muscles on the dorsal half on each side. Rows of stigmata 11-12, rarely 10; each comprising 20-25 elongate stigmata. Two or three muscle fibres along each transverse vessel which bears many papillae as shown in Fig. 1. Tentacles slender and 23 in an examined zooid, comprising large and small ones. Ciliated groove a small oval opening. Dorsal languets considerably long and slightly displaced to the left side from the dorso-median line. Anus bilobed and situated on the level of the transverse vessel from 5th to 6th.

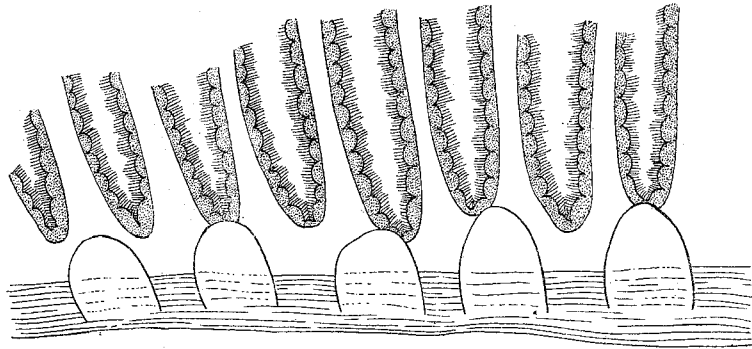


Fig. 1. *Polyclinum tsutsuii* n.sp. A part of the branchial sac, showing papillae on the transverse vessel, $\times 200$.

Abdomen: Alimentary canal lies almost horizontally. Stomach large and globular, situated slightly in front of the middle of the abdomen; the surface smooth. Mid-intestine distinct and constricted from the rectum before the canal reaches the posterior end of the abdomen. No coecum at the proximal end of the rectum. A distinct bend of rectum is found on the level of the hind-stomach.

Postabdomen: Club-shaped. Ovary is situated at the proximal part and contains several small ova, testis occupies the distal part and consists of 8-14 testicular follicles.

2. *Aplidiopsis tokaraensis* n. sp.

(Pl. XVIII, Fig. 4; Pl. XIX, Figs. 1-3)

Five colonies (Type 128) in the material from Takarazima, the largest one of which is 14 mm \times 9 mm in extent and 8 mm in height. They are roughly cubical in

shape and attached to the substratum by the underside. They carry white sand grains over the surface; consequently, neither system nor common cloacal aperture can be discerned with certainty. Some slight grooves and lobations may occur on the surface of colonies.

Test: Very soft, milky white in colour and translucent. Sand grains adhere merely to the surface, but never embedded in the test.

Zoid: About 3.5 mm in length in fully expanded state. Thorax and abdomen roughly equal in length in contracted state; the latter usually situated vertically in thicker parts of the colony, but frequently it may be bent horizontally in thinner parts of the colony as shown in Pl. XIX, figs. 2 and 3. Constriction between the thorax and the abdomen inconspicuous. Postabdomen is a slender sac protruded from the left side of the intestinal loop near the posterior end of the abdomen. It is very short in zooids sexually immature.

Thorax: Branchial aperture 8-(7 in some zooids) lobed, atrial languet terminates in a bluntly pointed, bi- or trifid end. Ten to twelve longitudinal muscles on each side of the thorax; these muscles are united into a pair of longitudinal muscle bands along the abdomen. Rows of stigmata 12-13, each row contains 18-20 stigmata. No papilla along the transverse vessel. About 8 large tentacles are discernible distinctly, probably besides a considerable number of small or minute tentacles alternating with larger ones. Smaller tentacles are, however, quite indiscernible in contracted zooids. Dorsal languets displaced slightly to the left side. Anus with thickened lips and situated at the height of the transverse vessel from 7th to 8th.

Abdomen: Stomach occupies a large part of the abdomen near the middle, elongate oval in outline and smoothly surfaced. Distinct constriction between the mid-intestine and the rectum at the posterior end of the abdomen, no coecum at the proximal end of the rectum. Gonads in postabdomen are immature.

3. *Amaroucium monotonicum* n. sp.

(Pl. XIX, Figs. 4-5; Pl. XX, Fig. 1)

Eleven colonies (Type 129) in the material from Takarazima. They are small, mushroom-shaped, about 3 mm in diameter and ca. 2 mm in height; usually stand erectly, although some colonies are lying obliquely. Each colony contains only a single system usually consisting of 6-7 (from 4 to 8) zooids surrounding a round common cloacal aperture at the centre.

Test: Soft and nearly transparent. The surface is smooth and holds no foreign matter.

Zoid: About 1.5 mm in length. Abdomen is slightly shorter than the thorax

in contracted state. Postabdomen as long as the abdomen. No constriction between the abdomen and postabdomen. Thorax orange red in colour when alive.

Thorax: Branchial aperture 6-lobed, atrial aperture round and with an atrial languet, the tip of which is undivided in some zooids, while it is bi- or trifold in others. About a dozen longitudinal muscles on each side of the thorax. Rows of stigmata 6, the number of stigmata in each row can not be given here definitely on account of rather strong contraction occurred on all zooids, though about 10 stigmata are esteemed in a row. Number of tentacles is also obscured by contraction, although about a dozen ones are esteemed. Dorsal languets distinct. Anus situated on the level of the 4th transverse vessel and surrounded with 2 lips. Embryos and eggs in various stages of development, up to 9 in all, are incubated in the dorsal side of the right peribranchial cavity.

Abdomen: Oesophagus very short. Stomach large and globular, situated slightly in front of the middle of the abdomen in contracted zooids and with 16-18 distinct longitudinal plications on the wall. Hind-stomach passes to the mid-intestine at the posterior end of the abdomen. No coecum at the proximal end of the rectum.

Postabdomen: Two mature eggs at the proximal end of the postabdomen. Testicular follicles arranged in two rows.

Larva: Trunk elliptical, 410μ in length; width/length is 0.54. Attachment processes cup-shaped and arranged linearly. Three finger-shaped bulbs, each ending in a rounded tip, are situated at the base of the attachment processes. In an examined larva, 5 small vesicles were found at the antero-dorsal and 10 ones at the antero-ventral part of the trunk. Two sensory pigment flecks arranged antero-posteriorly or obliquely. Larval test strongly granulated.

Remarks: It is the most remarkable characteristic of this new species, that each colony has merely a single system; hence the present nomenclature is derived.

4. *Didemnum* (*Didemnum*) *moseleyi* (HERDMAN), 1886

(Pl. XX, Figs. 2-7)

Many colonies (TK. Nos. 69-70) were collected in both Takarazima and Nakano-sima. As the structure of zooids is quite invariable in many species of *Didemnum* (*Didemnum*), we are often obliged to place reliance on the appearance of the colony and the shape of the spicules when many specimens of *Didemnum* are submitted to us for identification. However, the characteristics, mentioned above, vary so widely that the distinction of species is very hard and thus it is required to establish some provisional species or forms for convenience' sake to record the material, although some confusions may occur by the increase of names.

In the present case, there are two groups of colonies in the material of white-coloured *Didemnum*: one is undoubtedly *Didemnum (Didemnum) candidum* SAVIGNY and the other is a form containing in the test calcareous spicules which are larger than those of *Did. (Did.) candidum* and bear fewer rays on the equatorial plane. It is well known that spicules of the former show a considerably wide range of variation in size and appearance (cit.: VAN NAME 1945: Bull. American Mus. Nat. Hist., Vol. 84, pp. 83-86) and the shape and appearance of spicules in the latter are considered to be in the range of variation found in the former. But, at present, it is also an evident fact that there is not found any intermediate form between the two forms at least in the present material. Thus, I prefer to record here the latter under the name of *Did. (Did.) moseleyi* HERDMAN and to give some figures as materials for future studies.

Specimens from Takarazima: All colonies white. The largest one is 20 mm × 40 mm in extent, less than 1 mm in thickness. Distance between zooids usually 650 μ . Spacious lacunae only in the thoracic layer. The surface of colonies even, no common cloacal aperture is found in any specimen. Spicules distributed densely and evenly from the bottom to the surface very near the superficial layer. They are rather large, usually 40 μ in diameter, and may reach 48 μ in larger ones. Ten to twelve rays on the equatorial plane. Thorax less than 400 μ in a contracted state, abdomen up to 550 μ in length. Testicular follicle 1, proximal end of vas deferens coils 6-7 times. Trunks of embryos found in a colony ca. 400 μ in length, width/length ca. 0.5. Two sensory pigment flecks arranged dorso-ventrally in some examined larvae. The observation on a small number of specimens seems, however, to be of no important significance, because the arrangement of pigment flecks can be often shown in different appearances as described below on *Did. (Did.) candidum* (p. 246).

Specimens from Nakanosima: Spicules smaller than in the preceding specimens, 26 μ in the average and 32 μ in the maximum diameter; 8-12 rays on the equatorial plane.

4a. *Didemnum (Didemnum) moseleyi* f. *granulatum* nov.

(Pl. XXI, Figs. 1-4)

A considerable number of small and thin colonies (Type 130) in the material from Takarazima. Colony white in colour, common cloacal apertures oval in outline, few and small. The surface is densely covered with small (ca. 100 μ in diameter) ovoid protuberances which are nothing but accumulated spicules and give the surface a coarse granulated appearance. The arrangement of lacunae and the distribution of spicules are quite the same as in the typical form. Spicules usually 32 μ in

diameter, 52μ in the maximum. About 10 rays on the equatorial plane.

Zooid: Distance between zooids 580μ on an average. Each the thorax and the abdomen ca. 500μ in length. Retractable muscle of moderate length. Testicular follicle 1, the proximal end of vas deferens coils 5-6 times.

Larva: Length of trunk 280μ , width/length 0.66. Sensory pigment flecks arranged antero-posteriorly.

Remarks: The present form represents merely a granulated *forma* of *Did.* (*Did.*) *moseleyi*, because there are many intermediate states between the plain surface and the granulated one. I prefer to place here the present specimens under *Did.* (*Did.*) *moseleyi* on account of the close resemblance of the shape of calcareous spicules, although it is not impossible that the present form belongs to *Did.* (*Did.*) *candidum*. The larva seems too small for *D. moseleyi*, but fits to *D. candidum*.

4b. *Didemnum* (*Didemnum*) *moseleyi* f. *punici-color* nov.

(Pl. XXI, Fig. 5; Pl. XXII, Figs. 1-3)

A considerable number of small colonies (Type 131) from Nanatuyama Ura of Nakanosima. The largest one $17\text{ mm} \times 12\text{ mm}$ in extent; usually 1 mm in thickness, but rarely thicker at some places of the colony. The colony is pinkish when alive, but soon fades to white in preservation. The arrangement of lacunae is quite the same as in the typical form. The surface smooth. Spicules distributed densely and evenly from the bottom to the surface very near the superficial layer except for the small part above each zooid, where they are very sparse, aggregated merely along six lobes of the branchial aperture and thus the outline of the aperture is shown clearly on somewhat dark background. Spicules 32μ on the average and 38μ in the maximum diameter. Eight to twelve rays on the equatorial plane, each ray ends in a bluntly pointed tip or rarely nearly truncate distally in smaller spicules.

Zooid: Average distance between zooids 680μ . Thorax ca. 620μ in an expanded state, abdomen ca. 600μ in length. A small thoracic tubercle is found in the posterior half of the thorax on each side and contains some minute spicules in it. Retractable muscle rather long, muscles taken out wholly up to 1.2-1.6 times the length of the contracted thorax. A part of fibres of the retractile muscle proceeds anteriorly along the dorso-median line of the branchial sac. The boundary between the pyloric portion of stomach and the hind-stomach indistinct, while the mid-intestine distinct. Testicular follicle 1, the proximal end of vas deferens coils ca. 5 times.

Remarks: The pinkish hue occurs so constantly and on so many colonies collected in a wide area, that I am inclined to consider the present form as a distinct species. Somewhat long retractile muscle and the characteristic distribution of spicules above

zooids seem to encourage this idea. It is obvious, however, that more crucial studies, especially the statistical analyses and the close observations on various developmental stages, are required to settle the problem. Here, I can only record the present form provisionally under *Did. (Did.) moseleyi*.

5. *Didemnum (Didemnum) candidum* SAVIGNY, 1816

(Pl. XXII, Figs. 4-6; Pl. XXIII, Figs. 1-7)

Many colonies (TK. Nos. 71 and 72) from Takarazima, the largest one of which is 10 mm × 12 mm in extent. Colonies very thin, less than 1 mm in thickness and usually white in colour. Surface even; common cloacal apertures not numerous and oval in outline. The arrangement of lacunae as in the preceding species. Spicules are densely and evenly distributed in most of colonies. They are usually about 30 μ in diameter, although the maximum diameter may reach up to 46 μ . Rays numerous, short and bluntly tipped and about 20 in number on the equatorial plane.

Zooid: Thorax ca. 310 μ in strongly contracted state, abdomen ca. 500 μ in length. Retractable muscle of a moderate length. Branchial aperture distinctly 6-lobed. Thoracic tubercle a low elongate prominence near the ventro-posterior corner of the atrial aperture on each side of the thorax. Testicular follicle 1, proximal part of vas deferens coils 4-5 times.

Larva: Trunk 270-330 μ in length, ca. 290 μ on an average; width/length 0.6-0.7. Attachment processes 3 and arranged linearly; rarely they may be 2 or 1 in number or arranged in a triangle. Two sensory pigment flecks arranged most frequently antero-posteriorly, although they may be situated obliquely or dorso-ventrally in some larvae. For instance, among 45 examined larvae, 28 with antero-posteriorly arranged pigments, 15 with obliquely arranged pigments and 2 with dorso-ventrally arranged pigments. Among 20 examined larvae from a colony, 15 with three attachment processes, 3 with two processes and 2 with a single process.

Remarks: There are two groups of specimens which bear somewhat different appearances from that of the typical form mentioned above. The one contains two pinkish colonies from Takarazima. They are respectively 5 mm × 7 mm and 4 mm × 5 mm in extent and less than 1 mm in thickness. An oval common cloacal aperture, ca. 0.3 mm in long axis, at the centre of each colony. The surface is sprinkled sparsely with minute prominences each formed by aggregated spicules. Spicules ca. 30 μ in diameter, consist of many small and short rays and distributed densely and evenly from the bottom to the surface. Zooids rarely with retractile muscle of a considerable length.

The other consists of a few colonies, of which the largest one is 10 mm × 28 mm

in extent and ca. 1 mm in thickness. Colonies pale purplish gray in colour when alive. Zooids distributed evenly in the colony. The surface of the colony is raised around the branchial aperture of each zooid and appears uneven when observed under low magnification. Spicules very sparse, consequently the test is so translucent that yellowish-brown zooids can be seen through. Superficial spiculeless layer very distinct. Spicules are most densely aggregated along the floor of the lacunae, but they are quite missing in the bottom layer which is somewhat milky white. They are ca. 27μ in diameter, very rarely up to 45μ . Spindle cells in the transparent part of the test contain each 10–20 granules (Pl. XXIII, fig. 5). Thorax ca. 800μ in an expanded state, large abdomen $730\mu \times 680\mu$ and neck of a considerable length. Retractable muscle not long. About 7 stigmata in a row, dorsal languets long and slender. Anus opens on the level of the 3rd transverse vessel. Both hind-stomach and mid-intestine distinct. Proximal part of vas deferens coils $4\frac{1}{2}$ –8 times.

These two forms may be safely admitted as merely variants of *Did. candidum*.

6. *Didemnum* (*Didemnum*) *pulvinum* nom. nov.*

(Pl. XXIII, Figs. 8–10; Pl. XXIV, Figs. 1–5)

Many colonies (TK. No. 73) from Takarazima and a few ones from Nakanosima. Colonies small, the largest one 11 mm \times 6 mm in extent; 2–3 mm in thickness. Compared with the size, the thickness is rather large. This is due to the thick hypoabdominal bottom layer which is $1\text{--}1\frac{1}{2}$ times as thick as the layer containing zooids. Lacunae around the thorases and also the abdomens and contain numerous zoochlorellae in them. Surface even and coloured marginally white and greenish in central part when alive, but turns to pale yellowish in preservation in alcohol; underside pure white. Common cloacal apertures quite obscure on all examined colonies. Zoochlorellae up to 12μ in diameter and greenish in colour in fresh state. Spicules rather sparse in the layer containing zooids, while they are found very densely in the bottom layer. There is a thin superficial spiculeless layer. Spicules consist each of very numerous rays short and bluntly tipped. They are usually ca. 30μ in diameter, but up to 53μ in larger ones.

* Changes of names: Dr. A. J. BARFIELD of the British Museum called my attention on two homonyms which were found in my previous work "Ascidians from the Palao Islands I, Publ. Seto Mar. Biol. Lab., I (3) 1950". They are *Didemnum* (*Didemnum*) *gottschaldi* (p. 44) and *Polycarpa simplex* (p. 64). I became aware of the homonymy of the former immediately after the publication, but was quite ignorant of that of the latter. Here, I wish to express my hearty thanks to Dr. BARFIELD for his kind advice and revise these names as follows:
Didemnum (*Didemnum*) *gottschaldi* \rightarrow *Didemnum* (*Didemnum*) *pulvinum* nom. nov.
Polycarpa simplex \rightarrow *Polycarpa rubra* nom. nov.

Zooid: Average distance between zooids 480μ . Thorax 550μ in an expanded state, abdomen 450μ including testis and situated horizontally or slightly oblique. Deep constriction between the thorax and abdomen. Many zooids with buds at the oesophageal region.

Thorax: Branchial aperture 6-lobed, lobes rather indistinct; atrial aperture a huge opening extending dorsally near the endostyle. About 7 stigmata in each of 4 rows. Tentacles about a dozen, three dorsal languets distinct. Anus situated on the level of the 3rd transverse vessel and with thickened lips. A pair of strong muscle fibres along the dorso-median line of the branchial sac.

Abdomen: The division of alimentary canal is very indistinct superficially, only the posterior end of the mid-intestine is discernible with difficulties. In transparently prepared zooids, however, an oval gastric region can be observed very clearly. Ovary situated near the cardiac end of the stomach and usually contains an ovum; a single testicular follicle spherical, vas deferens quite straight at the proximal end.

Remarks: There is another stock of colonies (TK. No. 74) collected in Takarazima, the largest one of which is $12\text{ mm} \times 6\text{ mm}$ in extent and usually 1 mm in thickness. They are purplish gray or brownish in colour at places where spicules are sparse and zooids are seen through. The surface even, slightly granulated at places or raised slightly above each zooid. There may occur some shallow irregular grooves on the surface. Lacunae arranged as in the preceding description. Spicules very sparse at many places in the surface layer, but distributed rather densely in the abdominal layer. They may be 50μ in diameter in larger ones and usually defaced on the surface. Lacunae harbour abundant yellowish or brownish zoochlorellae which are larger than in the preceding specimens, usually ca. 16μ in diameter, but up to 20μ in larger ones. Thorax may reach 630μ in some zooids, while abdomen usually ca. 430μ in length. These specimens are regarded as colonies with thin bottom layer and harbouring another sort of zoochlorellae or fully grown up and partly yellowing zoochlorellae.

7. *Lissoclinum fragile* (VAN NAME), 1902

(Pl. XXIV, Figs. 6-7; Pl. XXV, Figs. 1-2)

A $20\text{ mm} \times 25\text{ mm}$ wide colony (TK. No. 75) detached imperfectly from the surface of a stone in Takarazima. It is probably 1.5 mm in thickness, the surface is smooth and pure white in colour. The colony consists of two thin layers, surface and bottom layers, and a spacious lacuna between these layers, in which zooids are situated nearly exposing their whole bodies. Abdomen placed on the floor horizontally with its right side upwards. Spicules consist of many short and truncate rays, usually

32 μ in diameter and reach up to 51 μ in larger ones. They are distributed evenly but not much densely.

Zooid: Average distance between zooids ca. 620 μ . Expanded thorax may be twice as long as the abdomen. Branchial aperture 6-lobed. About 7 stigmata in each of 4 rows; tentacles 14, large and small ones alternate regularly; ciliated groove an oval orifice and dorsal languets thin but long. Anus situated on the level of the 3rd transverse vessel. An elliptical thoracic tubercle near the antero-dorsal corner of the atrial opening on each side and contains in it an aggregation of small spicules. The boundary between the hind-stomach and the mid-intestine is clearer than that between the hind-stomach and the pyloric end of the stomach. A large ovum beside the outer edge of the stomach. Testicular follicles 2, proximal end of vas deferens swollen, but not coiled or curved.

Remarks: The present specimen differs from the preceding descriptions of *Liss. fragile* in the appearance of the atrial aperture, but this difference is probably due to the state of contraction. Any atrial languet can not be found on the present material; the anterior part of zooid adheres so tightly to the test that this part can not be taken out without any injury. *Diplosomoides molle* HERDMAN resembles closely the present specimen in the internal structure, but it differs distinctly from the latter in the shape of the colony which is not encrusting but forms a rounded mass in the former (Challenger Report Tunicata II, p. 310).

8. *Leptoclinum mitsukurii* (OKA), 1892

Small fragments from Takarazima, all examined zooids were immature sexually (TK. No. 79).

9. *Leptoclinum midori* n. sp.

(Pl. XXV, Figs. 3-7)

A few colonies (Type 132) from Takarazima and many colonies (TK. No. 76) from Nakanosima. They are usually small, 7 mm \times 11 mm—10 mm \times 15 mm in extent in larger ones; 1-3 mm in thickness. The colony coloured green all over and brilliant blue around the branchial apertures when alive. Common cloacal aperture only one in colonies of usual size. Zooids situated with their ventral sides towards periphery. About 110 zooids were counted in a colony 6 mm \times 8 mm in extent and 2 mm in thickness. Lacunae well developed and contain many zoochlorellae in them; chlorellae up to 18 μ in diameter. Preserved specimens easily lose the brilliancy and fade to a dark greenish tint; cut specimens become soon transparent, because zoochlorellae escape from the colony through the incision.

Zooïd: Thorax ca. 500 μ in length, abdomen ca. 640 μ in length including the testis. Usually four buds, large and small pairs of thoracic and abdominal buds, are found in the neck region. Branchial aperture 6-lobed, lobes small; 6 stigmata in each of 1st-3rd rows and 5 in the 4th row. Tentacles 6, dorsal languets small triangular processes. Retractable muscle short. Alimentary canal horizontal. The stomach tapering gradually to the following part of the canal. Fully matured ovum occupies the underside of the intestinal loop (Pl. XXV, fig. 5). Testicular follicles 2, both globular in shape (Pl. XXV, fig. 4).

Remarks: The present species resembles closely *Leptoclinum virens* HARTMEYER, but the latter differs distinctly from the former in the shape of the stomach which is somewhat rectangular in outline and constricted very clearly from the following part of the alimentary canal in the latter. *Midori* means the green colour in Japanese.

10. *Podoclavella polycitorella* n. sp.

(Pl. XXVI, Figs. 1-3)

The present new species seems to be solitary and is considered to bridge between Clavelininae and Polycitorinae. Many individuals (Type 133) were collected in Takarazima. The body elongate, 10 mm long in expanded state and attached to the substratum along the ventral side as shown in Pl. XXVI, fig. 1. The anterior portion of the body grayish green and fades toward the posterior portion where the yellowish orange alimentary canal can be seen through; both apertures and endostyle dark green. This ascidian always contracts so strongly whenever it is detached from the substratum, that it is almost impossible to obtain the expanded specimen even if the animal is treated in some anaesthetics after the collecting. I found merely a single expanded individual in the present material; the following descriptions are chiefly based on this sole specimen.

Test: Thin and soft, nearly colourless and transparent.

Mantle body: Thorax twice as long as the abdomen or more. The constriction between the thorax and the abdomen is not so remarkable.

Thorax: Both apertures indistinctly 6-lobed. Twelve to thirteen longitudinal muscles are running on each side of the thorax and united into a short but strong retractile muscle along the ventro-proximal part of the abdomen. Transverse muscle absent. Rows of stigmata 8, ca. 20 stigmata in each row. No papilla on the transverse vessel. Tentacles about a dozen, including large and small ones, ciliated groove a minute oval opening and seven triangular dorsal languets slightly displaced to the left side. Anus situated on the level of the 4th transverse vessel and with two thickened lips. Immature embryos up to 3 in number were observed in the

right peribranchial cavity at the dorso-posterior portion. In preserved specimens, slightly bluish in colour, especially darker in the anterior part around both apertures.

Abdomen: Less than $1/2$ of the length of the thorax even in strongly contracted state. Stomach situated near the middle, nearly spherical in outline and with smooth surface. Mid-intestine distinct, the proximal end of the rectum clearly constricted from the mid-intestine but forms no coecum. Ovary situated at the posterior end of the intestinal loop and contains several ova, testis is contained in a globular process protruded from the side of the intestinal loop and consists of ca. 20 follicles. This process is as large as the stomach and pale bluish in colour. It may be called more adequately "genital sac" than "postabdomen".

Remarks: Independence of each individual seems to place the present new species in Clavelininae, but it does not belong to *Clavelina*, because its stomach has no plication on the wall. Short abdomen, the existence of the genital sac are the characteristics common to the present new species and species in Polycitorinae. It is not impossible that this species represents a solitary form of *Polycitor* or a form of *Polycitorella*, which is solitary and devoid of spicules in the test. Also it is not impossible that I failed to find thin stolons connecting several individuals. Thus, after a long hesitation, I decided to place the present form provisionally under *Podoclavella*.

11. *Eudistoma snakabri* n. sp.

(Pl. XXVI, Figs. 4-5; Pl. XXVII, Figs. 1-5; Pl. XXVIII, Fig. 1)

Incrusting colonies (Type 134) found at Ōse in Takarazima, the largest one 45 mm × 60 mm in extent and up to 8 mm in thickness. The surface even but covered with many sand grains except for a few parts of the colony. Sand grains are also embedded in the test, especially densely in the abdominal layer. Test purplish black. System obscured by sand grains.

Zooid: Thorax may reach 3 mm in some contracted specimens; straightly stretched abdomen nearly 6 mm in length, but usually abdomen is bent strongly as shown in Pl. XXVII, figs. 4-5 and about a half as long as the thorax. Brownish orange in colour; stomach orange, the proximal part of the rectum coloured olive, but turns gradually to purplish brown according to approach near the distal part.

Thorax: Both apertures 6-lobed; atrial siphon very distinct, sometimes reach a considerable length (Pl. XXVIII, fig. 1). Twenty to thirty five longitudinal muscles on each side of the thorax, a considerably wide area along each side of the endostyle is devoid of these muscles. Transverse muscles very numerous, ca. 65 were counted in an examined zooid. About 20 long stigmata in each of 3 rows. Tentacles 20-25

including minute ones, two dorsal languets distinct, slightly displaced to the left side. Anus 2-lobed and situated on the level of the 2nd transverse vessel. Usually 1 or 2 embryos in the incubatory portion of the peribranchial cavity.

Abdomen: Oesophagus and rectum very long. Stomach situated in the posterior part, round in outline and without any plication of the wall. Mid-intestine distinct, descending and passes to the rectum slightly in front of the posterior end of the abdomen. No coecum at the proximal end of the rectum. Usually the rectum curves strongly on the level of the stomach; this bend is, however, probably due to the slight contraction of the abdomen. Testis situated in the intestinal loop posterior to the stomach and consists of follicles up to ca. 30 in number, ovary occupies the centre of the testis on the left side and usually a large ovum discernible there. A pair of longitudinal muscle bands along the ventral side on each side.

Larva: Trunk up to 1.2 mm in length, width/length 0.5–0.55. Three attachment processes arranged linearly. Distal end of each process elongate in outline. Many vesicular prominences in the anterior part of the trunk. Yellowish orange as a whole and sprinkled with minute reddish orange pigment spots which are found densely in the anterior part. Larval test frothy.

Remarks: *Eudistoma angolanum* MICHAELSEN resembles closely the present new species in the structure of zooids, especially in abundant transverse muscles on the thorax. The former differs, however, from the latter distinctly in the form and colour of the colony which is roughly hemispherical in shape and is not wholly pigmented in the former. *Snakabri* means the condition covered with sand grains in Japanese (*sun*a=sand, *kaburu*=be covered).

12. *Eudistoma rubra* n. sp.

(Pl. XXVIII, Figs. 2–6; Text-fig. 2)

Several colonies from Takarazima (TK. No. 77) and Nakanosima (Type 135). Colonies small, mushroom-shaped and each consists of a single corona and peduncle. For instance, in the largest colony in the present material the corona is 8 mm in diameter and 3 mm in height and the peduncle 5 mm in length. One colony in the material consists of two cormidia. Usually colonies are standing, though some colonies lying or situated obliquely or rarely quite irregular in shape, corona and peduncle being indiscriminate. About twenty zooids counted in a colony, 5 mm in diameter and 4 mm in height. Test of corona soft and quite transparent, pinkish orange thoraxes and reddish abdomens of zooids are seen through; peduncle yellowish brown, this colouration is due to the existence of faecal pellets which are found most abundantly near the basal portion, but sparsely in the corona around the

thorases or even near the surface. Some colonies pale orange when alive.

Zooid: Thorax 1.3 mm in length, abdomen up to 2.3 mm. Both apertures 6-lobed. Twelve to thirteen longitudinal muscles on each side of the thorax, transverse muscles absent. About 20 elongate stigmata in the 1st row, 12-15 ones in each of 2nd and 3rd rows; the dorsal part of the 1st row runs anteriorly along the dorso-median line as shown in Fig. 2. Tentacles 16, large and small ones alternate regularly; dorsal languets of moderate length. Anus situated on the level of the 2nd transverse vessel.

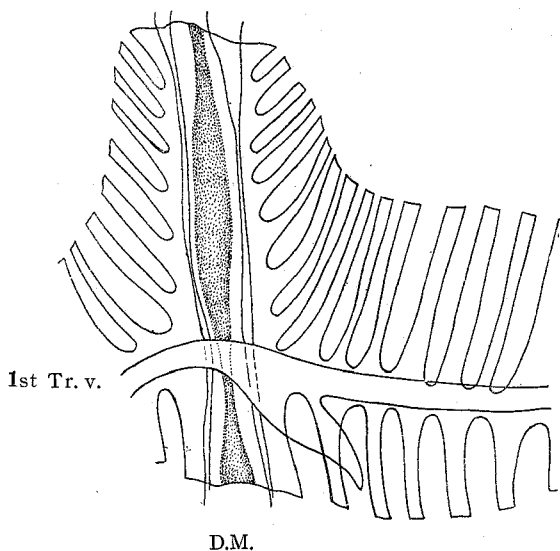


Fig. 2. *Eudistoma rubra* n. sp. Dorso-median part of the anterior portion of branchial sac, $\times 75$.
Tr. v.—transverse vessel, D.M.—dorso-median line.

Two embryos were found in some of the examined zooids. Stomach in the posterior part of the abdomen; mid-intestine distinct, situated at the posterior end of the abdomen horizontally or descending and passes to the rectum at the posterior end of the abdomen, rarely it is constricted from the hind-stomach at the posterior end of the abdomen and ascending. No coecum at the proximal end of the rectum. Gonad immature in all examined zooids.

Larva: Trunk $620\ \mu$ in an examined larva, width/length 0.6. Attachment processes cup-shaped and arranged linearly. Three vesicular prominences at the base of the attachment processes on each side. Sensory pigment flecks arranged antero-posteriorly. Larval test frothy.

13. *Eudistoma tokarae* n. sp.

(Pl. XXIX, Figs. 1-2)

Two colonies (Type 136) from Takarazima, they are club-shaped and respectively 6 mm and 4.5 mm in length; the former contains 12 zooids, while the latter 6 zooids. The surface of the corona is slightly raised above each zooid. Test milky white, translucent and sprinkled with minute dark greenish pigment spots. The lower part of the peduncle contains faecal pellets.

Zooid: Thorax 730 μ long in somewhat contracted state, abdomen up to 1.5 mm in length in slightly contracted state. The thorax is sprinkled with minute dark greenish pigment spots which are distributed densely in the anterior part and along the endostyle, especially remarkably at the dorsal ganglion and the anterior end of the endostyle. Both apertures 6-lobed, atrial siphon of considerable length in some zooids. About a dozen longitudinal muscles and about 30 transverse muscles on each side of the thorax, the latter converge dorsally into ca. 7 bundles. Anus with thickened lips and situated on the level of the 2nd transverse vessel. Stomach in the posterior portion of the abdomen, mid-intestine descending and passes to the rectum at the posterior end of the abdomen. No coecum at the proximal end of the rectum. All examined zooids immature sexually.

14. *Polycitor proliferus* (OKA), 1933

Many colonies were found commonly in both Takarazima and Nakanosima (TK. No. 78).

15. *Perophora listeri* var. *tokarae* nov.

(Pl. XXIX, Figs. 3-5)

A few individuals (Type 137) from Takarazima. They are very small, 2 mm in length and connected with the stolon at the postero-ventral part of the body. Test thin and transparent. About a dozen short longitudinal muscles at the antero-dorsal part of the body on each side, they are all converged to the branchial aperture. Muscles on each side are not continuous with each other directly.

Branchial sac: Four rows of stigmata. Inner longitudinal vessels quite absent, although supporting papillae remain in their natural appearance. Papillae somewhat elongate. Six large and six small tentacles alternate regularly.

Length of individual	Tentacle	Stigmata in each row	Longitudinal rows of papillae		Remarks
			Left	Right	
1.8 mm	6	14	5	5	immature
2 mm	12	13	5	6*	mature

* The 5th (ventral-most) row incomplete.

Alimentary system: Stomach globular and situated behind the branchial sac. Mid-intestine distinct, the proximal end of the rectum forms two pairs of small coeca. The second intestinal loop very shallow. The anterior end of the intestinal loop reaches near the 2nd transverse vessel. Anus plainly margined and situated on the level of the 3rd transverse vessel.

Gonad: Testicular follicles 2, ovary situated at the proximal end of vas deferens and consists of several ova.

Remarks: The present specimens differ from the type form of *Perophora listeri* in the number of the longitudinal rows of papillae, which are 8-9 on each side in the latter from the Palao Islands. Moreover, the former lack the inner longitudinal vessels completely. *P. sagamiensis* TOKIOKA also resembles the present specimens, but differs distinctly from the latter in the following two points; testicular follicle 1 and the longitudinal rows of papillae 10 on each side in the former. Thus, it seems to me most reasonable that the present specimens are treated here provisionally as a variety of *P. listeri*, because of the complete absence of the inner longitudinal vessels and the fewness of the papillae on each transverse vessel.

16. *Perophora formosana* (OKA), 1931

A considerable number of specimens were collected in both Takarazima and Nakanosima (TK. Nos. 80 and 81). The largest individual 3.5 mm in length.

17. *Ecteinascidia tokaraensis* n. sp.

(Pl. XXX, Figs. 1-5)

Several individuals from Takarazima (Type 138). The body is ovoid in outline, less than 7 mm in length; usually erect but sometimes lying obliquely. The animal attached to the substratum by the postero-ventral part of the body or a considerably wide area of the left side of the body. Test quite transparent, thin and delicate. About 15 transverse muscles on the dorsal side of the mantle body behind the atrial aperture. They are divided into anterior and posterior groups, muscles of the former encircle the atrial aperture, while those of the latter run straightly towards the

ventral side. Several muscles are issued from the anterior base of the atrial siphon towards the postero-ventral side. Ventral part of each muscle ramified into 2-5 branches falling in far distance from the endostyle. Stolon issued from the body near the posterior end of the endostyle on the level of the proximal end of the rectum. Branchial aperture 8-lobed, atrial aperture 9-lobed and situated on the level of the 2nd or 3rd transverse vessel.

Branchial sac: Eleven to thirteen rows of stigmata, for instance 11-11 or 12-13; 45-50 elongate stigmata in each row. Thirteen inner longitudinal vessels on each side, the dorsal-most of which incomplete and represented by a row of papillae, the next vessel is partly incomplete and rarely the ventral-most one is also partly incomplete. The vessel is supported by triangular processes at the ventral base of a small papilla at the apex of each process. Tentacles ca. 20 including large and small ones, besides several minute ones; each tentacle very slender. Ciliated groove an oval orifice. Dorsal lamina low membrane, a minute intermediate languet between ordinary languets at some places.

Alimentary system: Anterior margin of the intestinal loop reaches the 6-7th transverse vessel. Anus with plain margin and situated on the level of the 5-6th transverse vessel. The second intestinal loop wide and deep, the axis passes in front of the oesophagus. Stomach elongate, without any crest or plication on the surface; its posterior margin hardly beyond the posterior border of the branchial sac. Distinct constriction between the rectum and the mid-intestine.

Gonad: Many testicular follicles arranged in the 1st intestinal loop in the shape of \bigcirc surrounding the ovary which consists of 20-30 small ova.

18. *Ecteinascidia jacerens* n. sp.

(Pl. XXX, Figs. 6-8; Pl. XXXI, Figs. A-B; Pl. XXXII, Fig. 1)

Three individuals (Type 139) from Takarazima, less than 3 mm in length. The animal lying and attached to the substratum by the left ventral side of the body. A vessel issued from the body near the posterior end of the endostyle, but it is not clear whether this vessel is a stolonial vessel or one running into the test. The body roughly oval in outline. Branchial aperture subterminal and dorsal, atrial aperture near the middle of the body on the level of the 3rd row of stigmata; both apertures nearly plainly margined, though slightly sinuous; the branchial 16-lobed in some individuals. Test delicate, thin and transparent. Many delicate muscles only on the right side, they consist chiefly of transverse or oblique ones.

Branchial sac: Seven-eight rows of stigmata on the right side, eight rows on the left side; the 1st and 7th transverse vessels are not well developed and remain

in the state of the parastigmatic vessel in some individuals. Fifteen to twenty stigmata in a row. Some stigmata of the 1st and 2nd rows and those of the 7th and the 8th rows are often continuous with each other. Inner longitudinal vessels 8 (left)–9 (right) in an individual (A), while they are 11 in other one individual (B). One or two stigmata in a mesh. In the individual (A) the dorsal-most and the ventral-most vessels on the left side and the ventral-most one on the right side are incomplete, while in the individual (B) two dorsal and the ventral-most vessels on the right side and two dorsal and two ventral ones on the left side are incomplete. Fourteen to nineteen slender tentacles including large and small ones. Ciliated groove an oval orifice. Dorsal languets less than 6; the languet on the 1st transverse vessel minute or missing in some individuals, quite absent on the 7th transverse vessel. They are elongate triangular in shape.

Alimentary system: The anterior margin of the intestinal loop reaches the 4th transverse vessel or slightly beyond it. The 2nd intestinal loop wide and deep enough, the axis passes through the anterior opening of the oesophagus to the branchial sac. Stomach nearly globular or slightly elongate; two slight plications may occur on each side in some individuals, the posterior margin slightly beyond the posterior edge of the branchial sac. Mid-intestinal region discernible. In an individual a number of small round bodies were observed around the stomach as shown in Pl. XXXI, fig. B. Anus plainly margined and situated near the level of the 4th transverse vessel. Gonads immature in all individuals.

Remarks: *Ecteinascidia tortugensis* PLOUGH and JONES is a related species, but it has much more rows of stigmata, 18 in number. Some possibilities that the present form does not represent a distinct species but merely an earlier stage of some *Ascidia*, probably *Ascidia aperta*, can not be neglected here.

19. *Ascidia aperta* SLUITER, 1904

(Pl. XXXII, Figs. 2-8; Pl. XXXIII, Figs. 1-4)

SLUITER, C. Ph. (1904): Siboga-Exped., Monogr. LVIIa, pp. 38-39, Taf. II fig. 4, Taf. VI figs. 1-5.

VAN NAME, W. G. (1918): U.S. Nat. Mus. Bull. 100, Vol. 1, Pt. 2, pp. 119-121, figs. 75-76.

This ascidian is found commonly in Takarazima under stones in pools or in small crevices on the reef (TK. Nos. 82-85). Individuals found in crevices are usually oval in outline, smaller in size and coloured deep red in the anterior half and somewhat greenish in the posterior half, while those found under stones are somewhat elongate, larger, up to 53 mm in length and 26 mm in width, and coloured much palely. They are milky white, faintly yellowish or reddish orange in the anterior

part of the body near the branchial aperture.

The animal attached to the substratum by the whole left side. Branchial siphon terminal and short, short atrial siphon at the middle of the body or slightly in front of it. In smaller individuals, especially those found in crevices, the atrial siphon directed anteriorly and prolonged till the atrial aperture comes near the branchial aperture. The surface quite smooth and free from the foreign matters. Individuals collected from crevices or basal parts of corals are frequently holding some fragments of corals or shells at some parts of the surface.

Test: Soft gelatinous or cartilaginous, thin and quite transparent. In preserved specimens it is yellowish white and slightly roughened on the surface.

Mantle body: Mantle thin, the right side is wholly reticulated with thin muscle fibres, of which the transverse ones are developed better than the longitudinal ones. The branchial aperture 8-10 lobed, the atrial 8-11 lobed; lobes without pectination. Dorsal ganglion apart from the base of the branchial siphon $1/3-1/2$ of the distance between the bases of both siphons.

Branchial sac: Number of tentacles 43 in a 28 mm long individual, while up to 87 in a 53 mm long individual, besides a considerable number of minute ones. Ciliated groove simple crescent in form, apart from the dorsal ganglion about the length of the ganglion.

Body length	Longitudinal vessels	Transverse vessels
46-53 mm (3 ind.)	30-37 ~ 35-39	80-99
28-30 mm (2 ind.)	28-33 ~ 30-32	56-66

Plications distinct in large individuals, 6-12 stigmata in a mesh. About three thinner transverse vessels between each pair of thicker ones. Intermediate papillae present. Dorsal lamina ribbed, distal ends of ribs project beyond the margin of the lamina.

Alimentary system: The anterior end of the intestinal loop never beyond the middle of the base of the atrial siphon. The second intestinal loop extremely shallow, its axis passes through the oesophagus or in front of it; practically absent in some specimens (Pl. XXXIII, fig. 4). Oesophagus opens to the branchial sac slightly in front of the posterior end of the branchial sac. Stomach spherical in outline and usually with 1-2 irregular ridges on each side (up to 5 in total). The distal part of the rectum becomes thinner. Anus bilobed, each lobe plainly margined, and opens near the level of the anterior end of the 1st intestinal loop.

Gonad: Ovary consists of a tubular organ running along the middle part of the 1st intestinal loop and issues 8-10 branches spreading on the inner side of the

intestine and sometimes ramified again into a few short branches; oviduct straight or has a remarkable bend at the middle of its course. Testicular follicles minute, whitish in colour and spread on the inner side of the intestine, extending from the pyloric portion of the stomach to the middle of the intestine. In some individuals many concentric yellowish brown bodies of unknown nature are found in the frothy tissue covering the alimentary canal from the stomach to the distal end of the gonad.

20. *Ascidia beta* n. sp.

(Pl. XXXIV, Figs. 1-5)

A small, 8 mm long \times 3 mm wide, individual from Nakanosima (Type 140). The body elongate oval in outline, attached to the substratum by the whole left side. The surface even and carries no foreign matter. Branchial aperture subterminal, atrial aperture at the middle of the body; both apertures sessile. Test soft and quite transparent.

Mantle body: 5 mm in length. The right side is wholly reticulated complexly with muscle fibres. Branchial aperture 10 (?) and atrial aperture 8 (?)-lobed. Dorsal ganglion near the middle of the distance between both apertures.

Branchial sac: Tentacles ca. 25 in all, including long and short ones. Ciliated groove simple transverse groove slightly concave anteriorly and apart from the dorsal ganglion about the length of the ganglion. Plications absent. Longitudinal vessels 27 (left)-33 (right), transverse vessels ca. 40; 1-2 stigmata in a mesh. Papillae very small, intermediate papillae absent. Dorsal lamina ribbed, distal ends of ribs beyond the margin of the lamina.

Alimentary system: The anterior margin of the intestinal loop on the level of the anterior side of the atrial aperture. The 2nd intestinal loop narrow and deep, the axis passes through in front of the cardiac end of the stomach which is somewhat elongate in form and without any plication on the surface. Oesophagus opens to the branchial sac at the dorso-posterior corner of the body. Slight constriction between the rectum and the short mid-intestine. Anus plainly margined and situated slightly posterior to the anterior margin of the 1st intestinal loop. Gonad immature.

21. *Botrylloides violaceum* OKA, 1927

Many fragments from Takarazima (TK. No. 89), all purplish brown in colour. There are two colonies, each covering the carapace of *Cryptodromia* sp., they are respectively 16 mm \times 20 mm and 16 mm \times 22 mm in extent and both 2 mm in thickness. Zooids up to 2.5 mm in length, erect in thicker colonies, but lying in thinner colonies

which may be only 1 mm thick in preserved state. Rows of stigmata usually 12 (11-13), stigmata arranged D. 5. 3-4. 3. 3-4. V. Anus situated most frequently on the level of the 9th transverse vessel, rarely 8th or 10th. Plications on the stomach usually 9 (rarely 8), besides a small one representing typhlosome. There are one small colony (TK. No. 90) coloured reddish brown and two small colonies (TK. No. 91), respectively 10 mm×6 mm and 8 mm×5 mm in extent, in which zooids are provided with rather fewer rows of stigmata, 9-10. Besides, three small colonies which consist merely of abundant ampullae and contain no developed zooid. These colonies are considered as being in the resting stage before the abrupt growth of the colony, which may be induced by the simultaneous growing of ampullae. The largest one of these colonies is 13 mm×8 mm in extent and 1 mm in thickness.

22. *Polycarpa takarazima* n. sp.

(Pl. XXXIV, Figs. 6-9; Pl. XXXV, Figs. 1-3)

Several individuals (Type 141) from Takarazima, the largest one of which is 13 mm in length. Body slightly elongate, attached to the substratum by the left ventral part of the body, where the test is extremely thin. Branchial aperture subterminal, atrial aperture near the middle of the body; both apertures sessile.

Test: Soft leathery, of moderate thickness, translucent and milky white to yellowish white in colour. The surface is slightly wrinkled and is adhered sparsely with sand grains.

Mantle body: Mantle of moderate thickness and pale grayish brown or pale greenish brown in colour; greenish colouration is remarkable around the apertures. Branchial siphon terminal or subterminal. Both siphons very short and 4-lobed. Many endocarps on the inner surface. Atrial tentacles fine and slender, but placed not so thickly.

Branchial sac: Inner longitudinal vessels arranged as follows:

13 mm long individual:

Left	D.	0	(14)	1	(12)	1	(14)	1	(11)	1	V.
Right	D.	0	(13)	2	(12)	1	(13)	1	(9)	1	V.

12 mm long individual:

Left	D.	1	(10)	2	(8)	2	(10)	2	(8)	1	V.
Right	D.	1	(10)	2	(10)	1	(10)	2	(8)	2	V.

Thicker transverse vessels and thinner ones alternate regularly, parastigmatic vessels present. Stigmata in a mesh less than 7, but up to ca. 10 in meshes along each side of the endostyle. Tentacles ca. 30, including large and small ones, in a

13 mm long individual, ca. 25 in 10–12 mm long individual; frequently they are coloured dark olive brown. Ciliated groove C-shaped, opened towards the right as we face it.

Alimentary system: Alimentary canal occupies the posterior $1/2-1/3$ of the left half of the body. The second intestinal loop wide, the axis passes through the middle of the oesophagus. Stomach oval, at least a half as long as the ventral branch of the 1st intestinal loop and with 6–8 distinct plications on each side; plications dark greenish or striped with green and dark brown. Pyloric coecum present, though small. Two or three large endocarps in the 1st intestinal loop, often besides a small one. The free margin of anus finely lobated, 9–10 in all.

Gonad: Elongate gonads aggregated in the ventral half on each side; 14 (left)–11 (right) in a 13 mm long individual, 2 (left)–8 (right) in a 12 mm long individual and 4 (left)–7 (right) in a 10 mm long individual. About 10 testicular follicles roughly arranged in a row on the side of attachment of each gonad.

Remarks: The present new species resembles closely *Cnemidocarpa areolata*, but the arrangement of gonads in the former is clearly of *Polycarpa*-type, the shape of the ciliated groove differs distinctly from that of the latter and the endocarps in the 1st intestinal loop are fewer than in the latter.

23. *Cnemidocarpa areolata* (HELLER), 1878

(Pl. XXXV, Figs. 4–7)

A 7.5 mm long \times 5 mm wide individual (TK. No. 86) from Takarazima. The animal attached to the substratum by the left ventral side of the body which is roughly oval in outline. Branchial aperture terminal and faced slightly dorsads, the anterior margin of the atrial aperture at the middle of the body; both apertures 4-lobed. Test milky white, translucent and with a few faint irregular wrinkles on the surface. Thirty to forty longitudinal muscles arranged regularly on both sides except for the postero-ventral quarter of the left side occupied by the alimentary canal. Two large endocarps on the right and about 10, including large and small ones, on the left side. Atrial tentacles ca. 20, delicate but fairly long.

Branchial sac: Tentacles ca. 20, large and small ones alternate regularly; besides ca. 10 minute ones. Ciliated groove a transverse groove slightly concave anteriorly. Inner longitudinal vessels arranged as follows:

Left	D.	0	(5)	2	(7)	2	(7)	2	(6)	1	V.
Right	D.	0	(5)	2	(6)	2	(7)	2	(6)	2	V.

Transverse and parastigmatic vessels alternate regularly. Four to six stigmata in a mesh.

Alimentary system: Stomach globular, with ca. 8 plications on each side; pyloric coecum indiscernible. One large and one small endocarps in the 1st intestinal loop. The axis of the second intestinal loop passes through the middle of the stomach. Anus faintly lobated. Gonad immature.

Remarks: This young specimen seems to belong to *Cn. areolata* rather than to the preceding species. Shallow second intestinal loop, the direction of its axis and the immaturity at the present body size seem to guarantee the present identification. Regular arrangement of longitudinal muscles is probably a feature found merely in very young stages.

24. *Styela partita* (STIMPSON), 1852

(Pl. XXXVI, Figs. 1-7; Pl. XXXVII, Fig. 1)

Twenty eight specimens (TK. No. 87) from Takarazima, all smaller than 10 mm in length. The animal adheres to the substratum by the left ventral side of the body which is roughly elongate oval in outline. Branchial aperture subterminal and slightly faced dorsads, the atrial aperture near the middle of the body; both apertures sessile and 4-lobed.

Test: Leathery, of moderate thickness and reddish brown on the dorsal side, especially darkly coloured around the apertures, and fades towards the side of attachment, where the test is extremely thin and yellowish white. The surface is irregularly wrinkled in preserved specimens.

Mantle body: Mantle thin, yellowish white to pale orange in colour. Both siphons very short. Endocarps found on the inner surface on both sides, they are somewhat large but few in number. Fine atrial tentacles arranged thickly on the atrial velum.

Branchial sac: Twenty five to thirty three tentacles including large and small ones. Ciliated groove represented by a simple slit. Inner longitudinal vessels as follows:

10 mm long individual:

Left	D.	0	(6)	1	(5)	1	(10)	1	(6)	1	V.
Right	D.	1	(11)	1	(10)	0	(11)	1	(9)	1	V.

9 mm long individual:

Left	D.	1	(6)	1	(7)	0	(5)	1	(7)	0	V.
Right	D.	1	(9)	1	(7)	0	(7)	1	(6)	1	V.

Thicker transverse vessels and thinner ones alternate regularly, parastigmatic vessels occur regularly. Four to five remarkably long stigmata in a mesh, meshes along each side of the endostyle contain much more stigmata.

Alimentary system: The anterior margin of the intestinal loop reaches the middle or nearly $2/3$ of the body. The second intestinal loop very large, the axis passes through the oesophagus. Stomach elongate, much longer than a half of the ventral branch of the 1st intestinal loop, with ca. 8 plications on each side and a distinct and large pyloric coecum. Two-four endocarps in the 1st intestinal loop. Anus plainly margined or with a few indistinct lobes.

Gonad: Two on each side, rarely some of them are missing. Testicular follicles situated at the posterior end of each elongate ovary, 2-4 in number and complexly lobed in some specimens.

Larva: In a specimen, two larvae were found in the peribranchial cavity. They are 1 mm in length; trunk about 200μ in length, width/length 0.6. Three attachment processes minute. Sensory pigment fleck/trunk width 0.18.

Remarks: The present specimens differ from the typical form of *St. partita* in the following 3 points, besides several slight differences: (1) endocarps few but large, (2) a few testicular follicles confined to the posterior end of the ovary and (3) stomach large, elongate and with fewer plications. These differences are, however, attributable to the environmental condition which allowed the animals to attain the maturity at such small body size.

25. *Microcosmus curvus* n. sp.

(Pl. XXXVII, Figs. 2-9)

Numerous specimens from both Takarazima (Type 142) and Nakanosima (TK. No. 88), the largest one of all is 12 mm in length. The animal roughly oval in shape and attached to the substratum by the right ventral side of the body. The branchial aperture terminal or subterminal, the atrial at the middle of the body or slightly posterior to it, both apertures 4-lobed. Siphons short; a specimen from Nakanosima has a long branchial siphon as shown in Pl. XXXVII, fig. 3. Usually dark violet when alive, but fades to purplish brown in preservation. Some specimens from Nakanosima are reddish brown in colour and I dealt them, at a sight, erroneously with *St. partita*.

Test: Leathery, very tough and moderately thick on the dorsal side but very thin and coloured yellowish brown at the side of attachment. The surface is irregularly wrinkled and provided with many shallow grooves.

Mantle body: Mantle pale yellowish orange as a whole, siphons pale orange. Muscles arranged very regularly as in other species of the genus. Endocarps absent.

Spinules on the distal part of the stomodaeum $17-22\mu$ in length. Atrial velum indistinct.

Branchial sac: Usually six folds on each side.

12 mm long individual:

Left D. 1 (15) 1 (15) 1 (14) 1 (13) 1-2 (12) 2 (8) 1 V.

Right D. 1 (15) 1 (12) 1 (14) 1 (15) 2 (13) 1-2 (10) 0 (6) 0 (4) 0 V.

10 mm long individual:

Left D. 1 (12) 1 (9) 1 (11) 1 (11) 1 (10) 1 (6) 1 V.

Right D. 0 (11) 1 (8) 1 (12) 1 (11) 1 (12) 1 (8) 1 V.

Folds VII and VIII on the right side in a 12 mm long individual are confined to the anterior portion of the sac. A 5 mm long individual from Nakanosima has only 5 folds on the left side. One or two thinner transverse vessels between each pair of thicker ones, parastigmatic vessels present. Three to six stigmata in a mesh. Tentacles short and thick, 17-21 including large and small ones; branches in 2 orders, those of the second order are few. Ciliated groove U-shaped, with one or both arms curled in.

Alimentary system: Liver forms a mass and pale greenish in colour. Anus with two plain lips.

Gonad: A strongly curved genital capsule on each side. Oviduct always opens towards the branchial siphon. The capsule on the left side lies across the dorsal branch of the 1st intestinal loop.

Remarks: The constantly curved gonad is the most remarkable characteristic of the present new species.

EXPLANATION OF PLATE XVIII

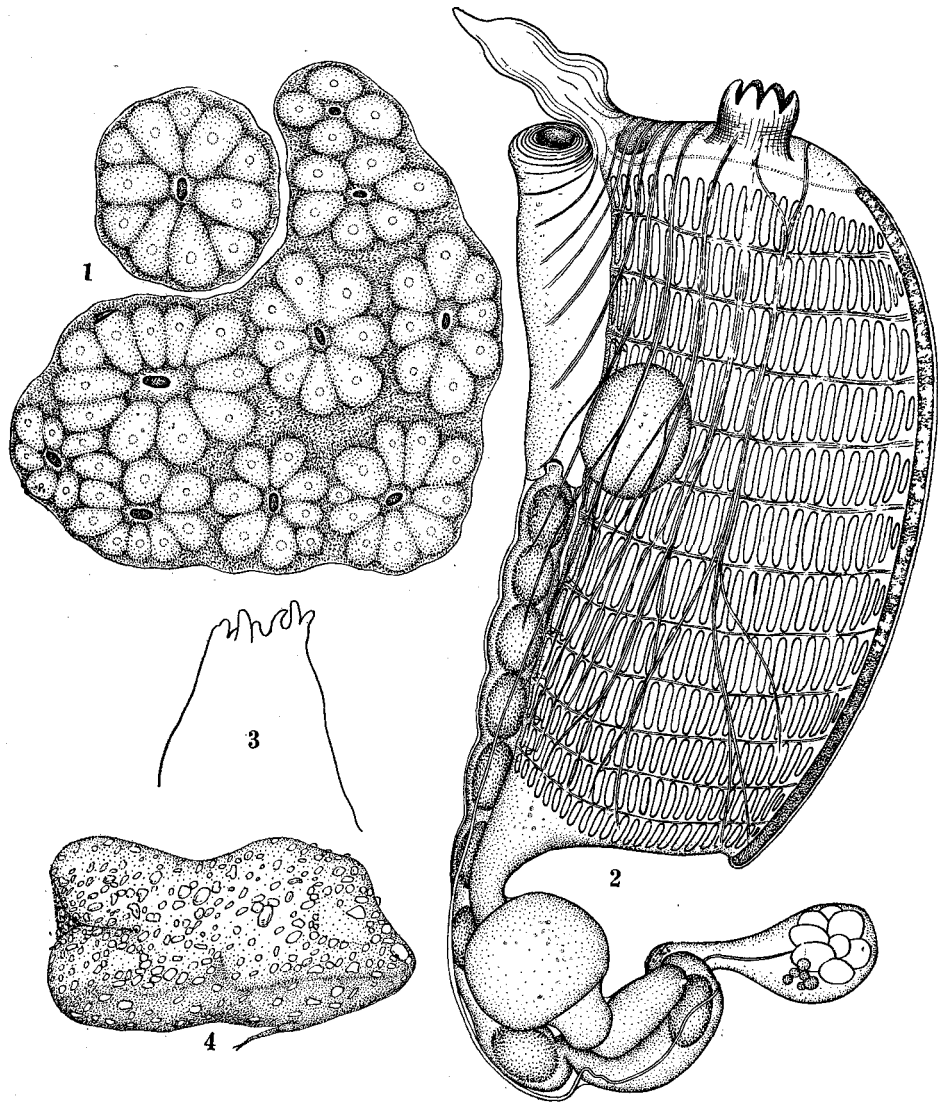
Figs. 1-3. *Polyclinum tsutsui* n. sp.

1—Two colonies, enlarged.

2—Zooid from right side, magnified.

3—Tip of atrial languet. $\times 80$.

Fig. 4. *Aplidiopsis tokaraensis* n. sp. A colony, enlarged.



EXPLANATION OF PLATE XIX

Figs. 1-3. *Aplidiopsis tokaraensis* n. sp.

1—Zooid from right side. $\times 33$.

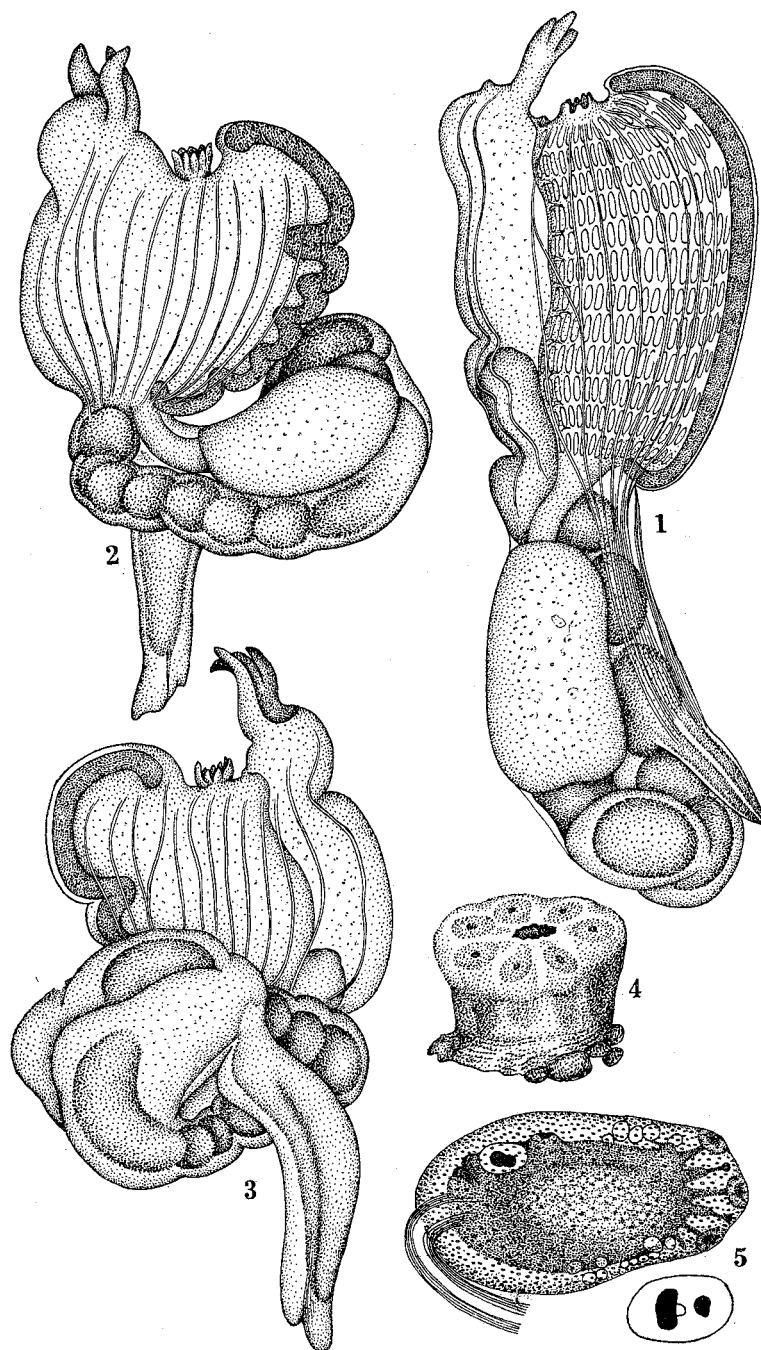
2—Contracted zooid from right side. $\times 33$.

3—Contracted zooid from left side. $\times 33$.

Figs. 4-5. *Amaroucium monotonicum* n. sp.

4—A colony, enlarged.

5—Larva from right side, $\times 110$; with statocyst, magnified.



EXPLANATION OF PLATE XX

Fig. 1. *Amaroucium monotonicum* n. sp. Zooid from right side. $\times 75$.

Figs. 2-7. *Didemnum (Didemnum) moseleyi* (HERDMAN)

2—Schema of the section of colony.

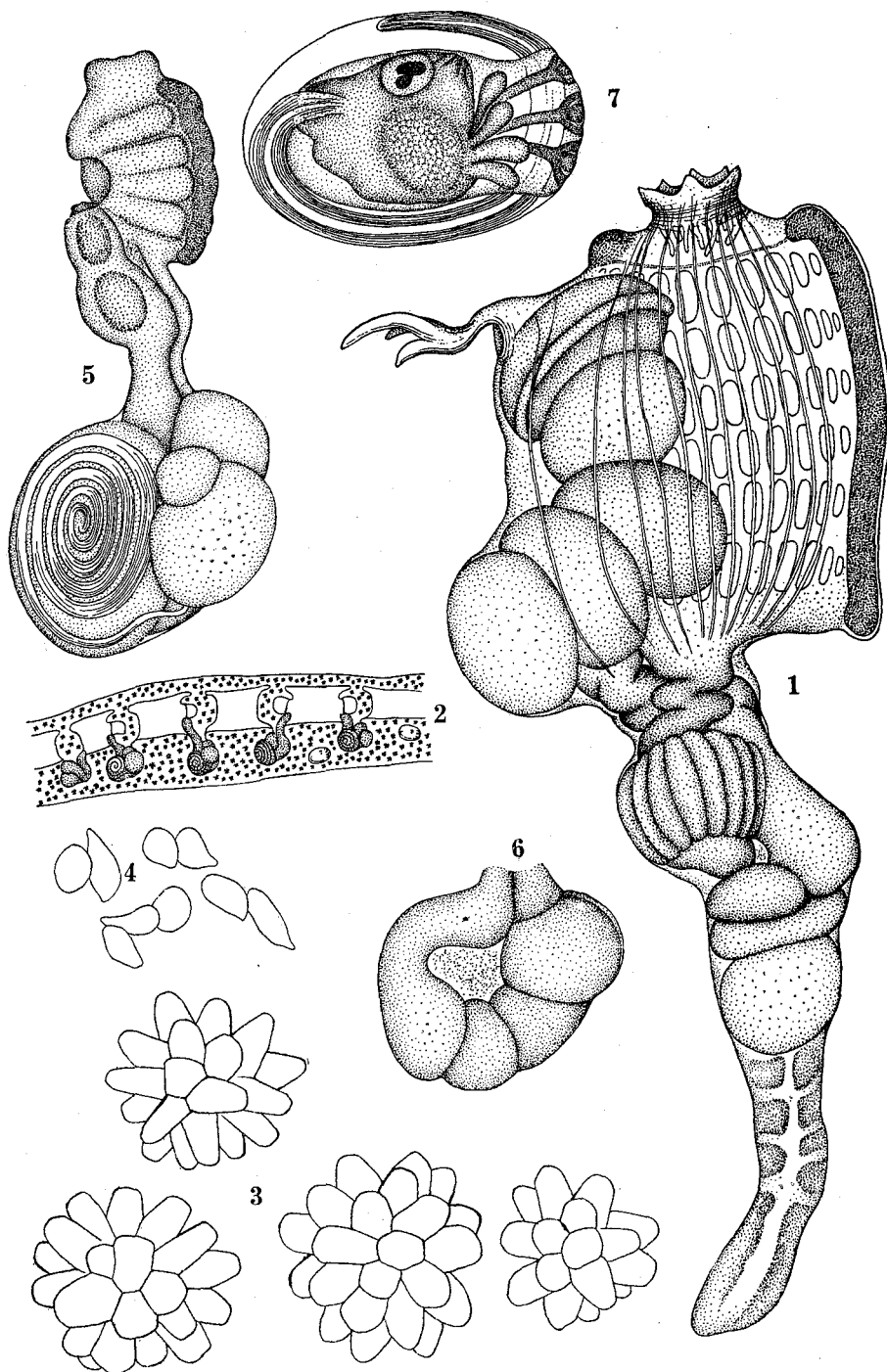
3—Calcareous spicules. $\times 630$.

4—Bladder cells in test. $\times 630$.

5—Zooid from right side. $\times 75$.

6—Abdomen. $\times 75$.

7—Embryo from right side. $\times 110$.



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EXPLANATION OF PLATE XXI

Figs. 1-4. *Didemnum (Didemnum) moseleyi* f. *granulatum* nov.

1--A part of the surface of colony. $\times 75$.

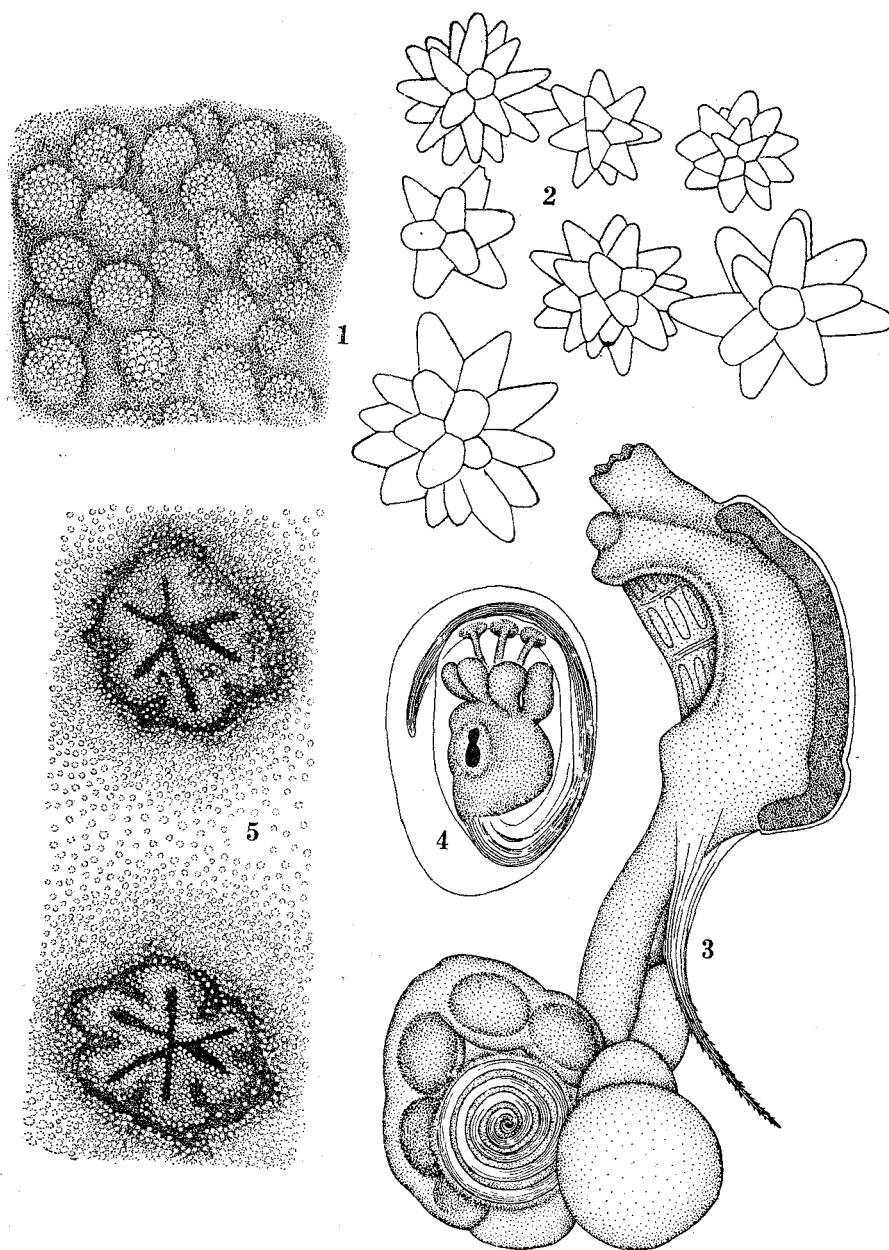
2--Calcareous spicules. $\times 630$.

3--Zooid from the right side. $\times 110$.

4--Embryo from right side. $\times 110$.

Fig. 5. *Didemnum (Didemnum) moseleyi* f. *punici-color* nov.

A part of the surface of colony, showing two
branchial apertures. $\times 75$.



EXPLANATION OF PLATE XXII

Figs. 1-3. *Didemnum (Didemnum) moseleyi* f. *punici-color* nov.

1—Calcareous spicules. $\times 630$.

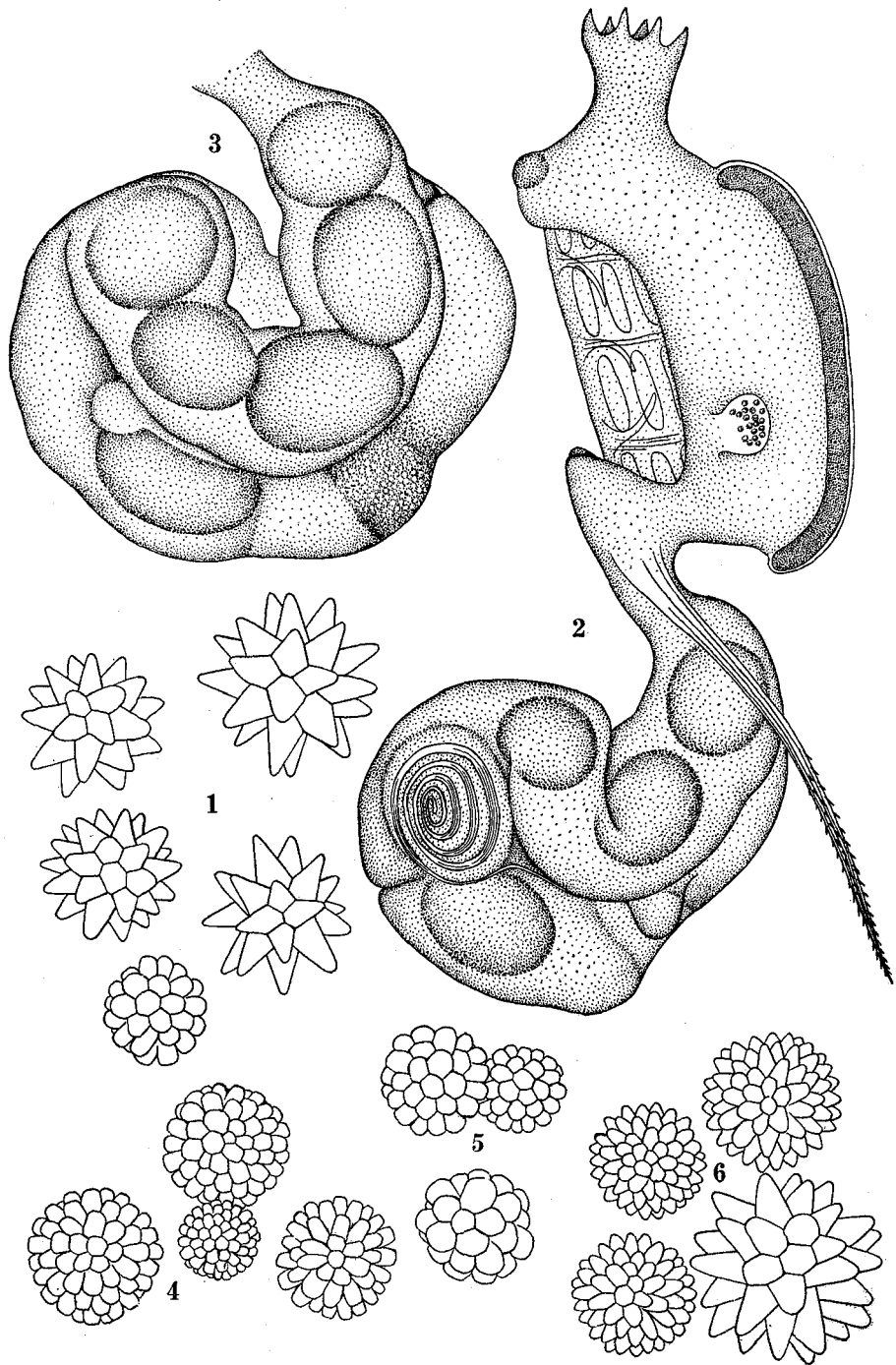
2—Zooid from right side. $\times 110$.

3—Abdomen with immature gonad. $\times 110$.

Figs. 4-6. *Didemnum (Didemnum) candidum* SAVIGNY.

4, 5—Calcareous spicules from different colonies spiculate densely. $\times 630$.

6—Spicules from the colony spiculate rather sparsely.
 $\times 630$.



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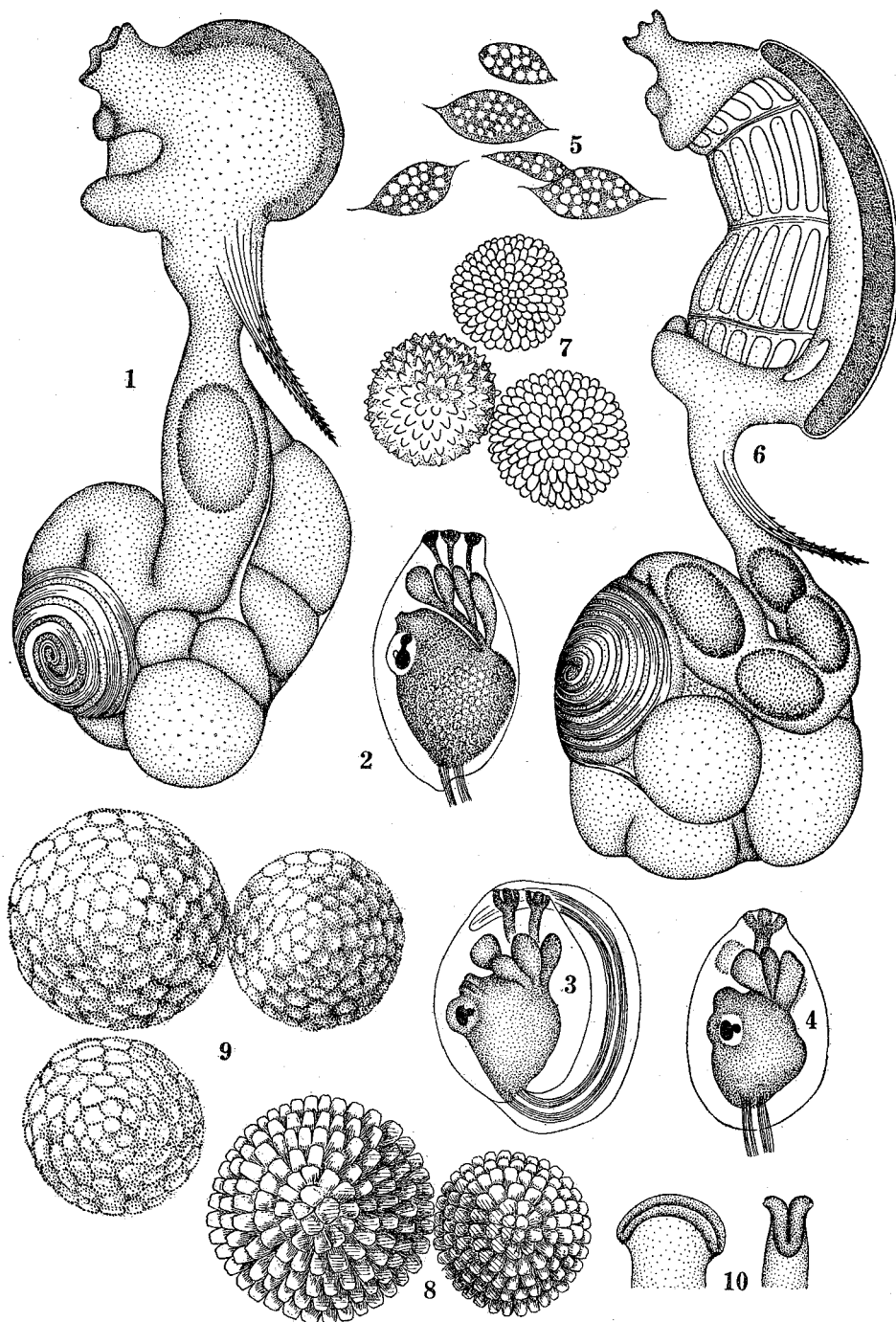
EXPLANATION OF PLATE XXIII

Figs. 1-7. *Didemnum (Didemnum) candidum* SAVIGNY

- 1—Zooid from right side (contracted). $\times 110$.
- 2—Normal larva from right side. $\times 110$.
- 3—Larva with 2 attachment processes. $\times 110$.
- 4—Larva with a single attachment process. $\times 110$.
- 5—Granulated spindle cells in test. $\times 630$.
- 6—Zooid from right side (expanded). $\times 75$.
- 7—Calcareous spicules from a pinkish colony. $\times 630$.

Figs. 8-10. *Didemnum (Didemnum) pulvinum* nom. nov.

- 8—Calcareous spicules from a greenish colony. $\times 630$.
- 9—Calcareous spicules from a yellowish-brown colony. $\times 630$.
- 10—Anus of zooid, magnified.



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EXPLANATION OF PLATE XXIV

Figs. 1-5. *Didemnum* (*Didemnum*) *pulvinum* nom. nov.

1—Schema of the optical section of the colony, enlarged.

2—Zoochlorellae from greenish colonies. $\times 1200$.

3—Zoochlorellae from yellowish-brown colonies. $\times 1200$.

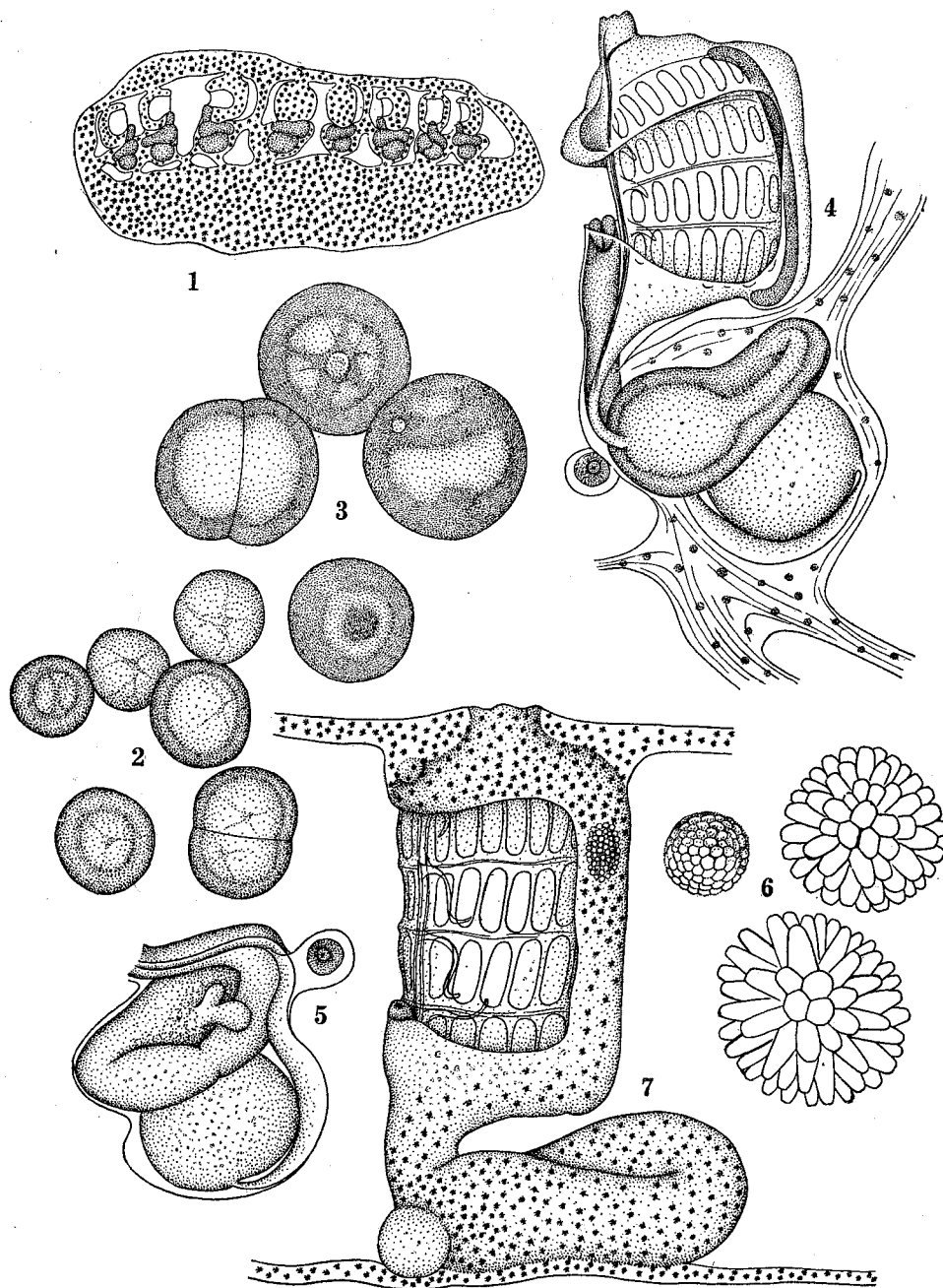
4—Zooid from right side. $\times 75$.

5—Abdomen from left side. $\times 75$.

Figs. 6-7. *Lissoclinum fragile* (VAN NAME),

6—Calcareous spicules. $\times 630$.

7—Zooid from right side, magnified.



EXPLANATION OF PLATE XXV

Figs. 1-2. *Lissoclinum fragile* (VAN NAME)

1--Abdomen from upper side. $\times 75$.

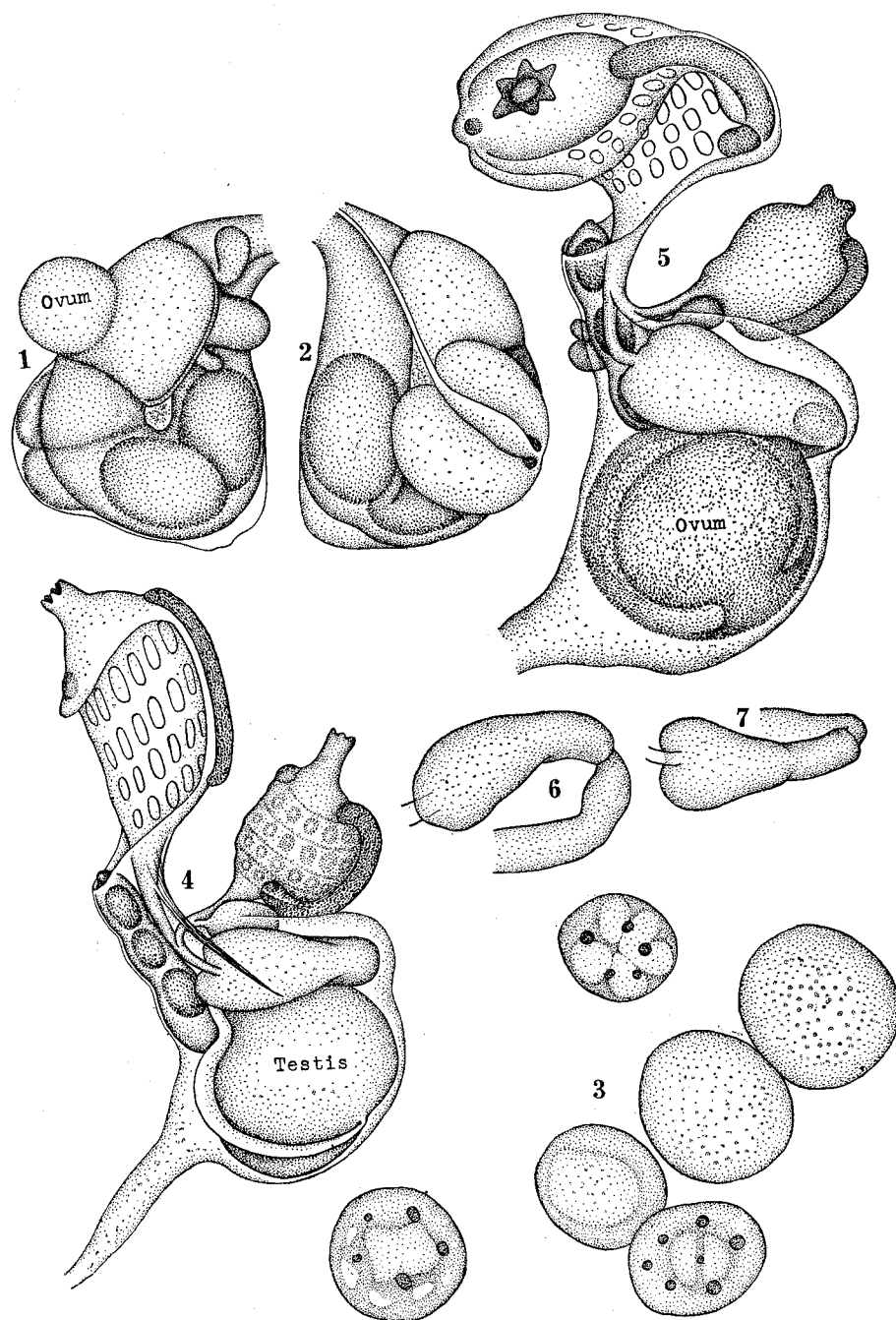
2--Abdomen from under side. $\times 75$.

Figs. 3-7. *Leptoclinum midori* n. sp.

3--Zoochlorellae. $\times 1200$.

4, 5--Zooids from right side. $\times 75$.

6, 7--Alimentary canals. $\times 75$.



EXPLANATION OF PLATE XXVI

Figs. 1-3. *Podoclavella polycitorella* n. sp.

1--An individual from right side, enlarged.

2--Mantle body from right side, magnified.

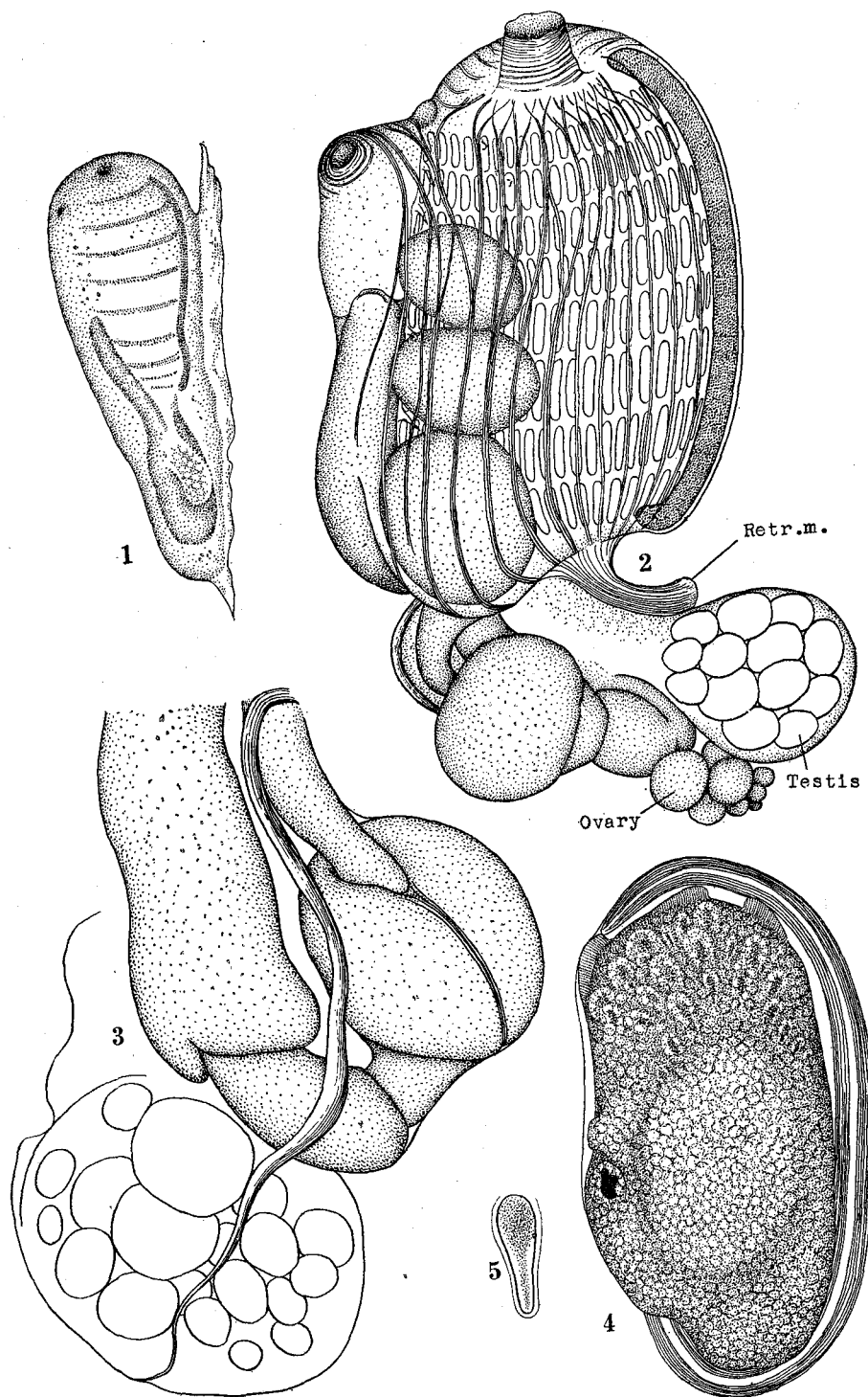
Retr. m.--retractile muscle.

3--Genital sac and posterior part of abdomen. $\times 75$.

Figs. 4-5. *Eudistoma snakabri* n. sp.

4--Embryo from right side. $\times 55$.

5--Distal end of an attachment process, magnified.



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EXPLANATION OF PLATE XXVII

Figs. 1-5. *Eudistoma snakabri* n. sp. $\times 25$.

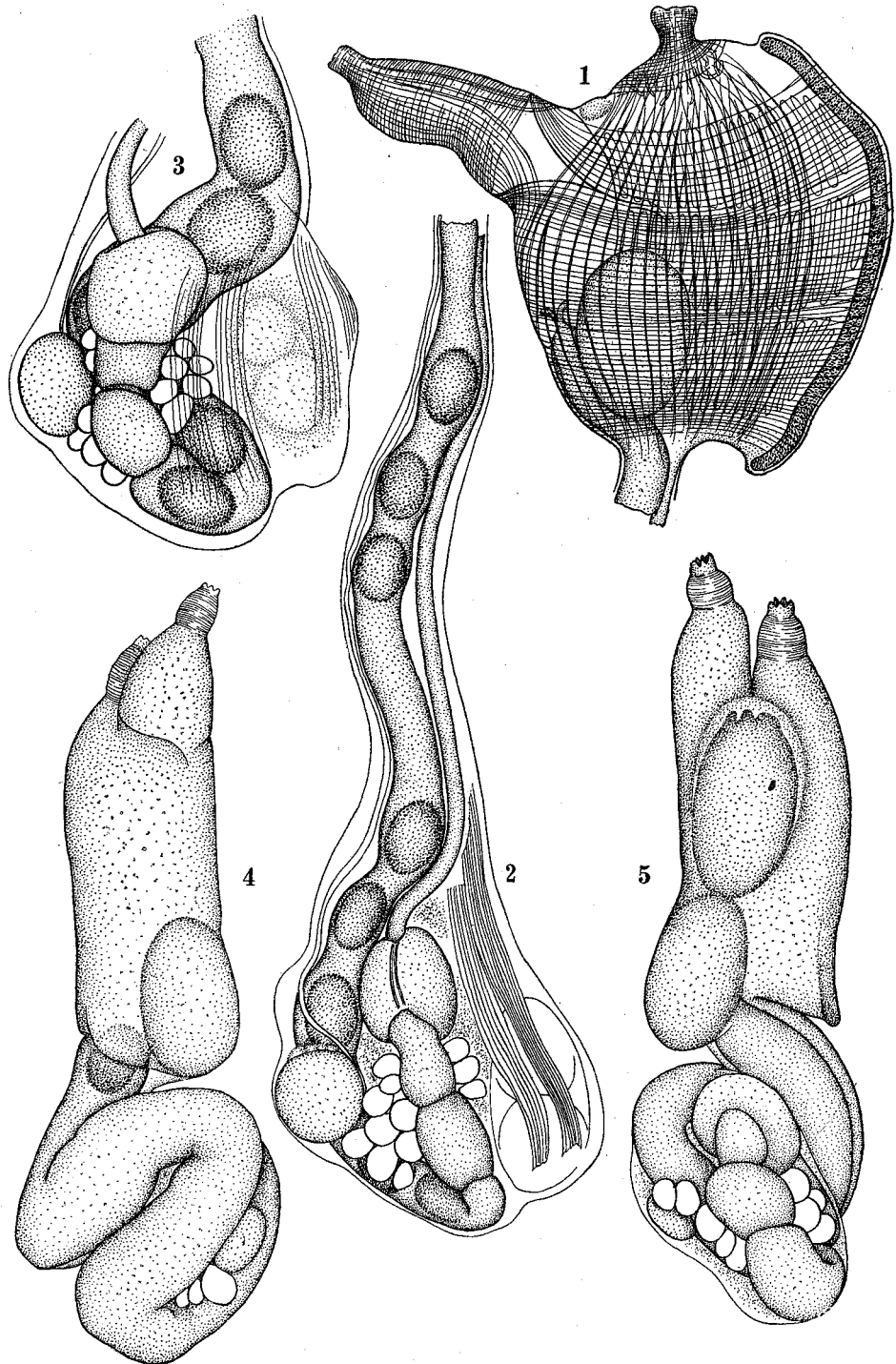
1—Thorax from right side.

2—Abdomen.

3—Posterior part of abdomen.

4—Contracted zooid from left side.

5—Contracted zooid from right side.



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EXPLANATION OF PLATE XXVIII

Fig. 1. *Eudistoma snakabri* n. sp. Thorax with long atrial siphon. $\times 25$.

Figs. 2-6. *Eudistoma rubra* n. sp.

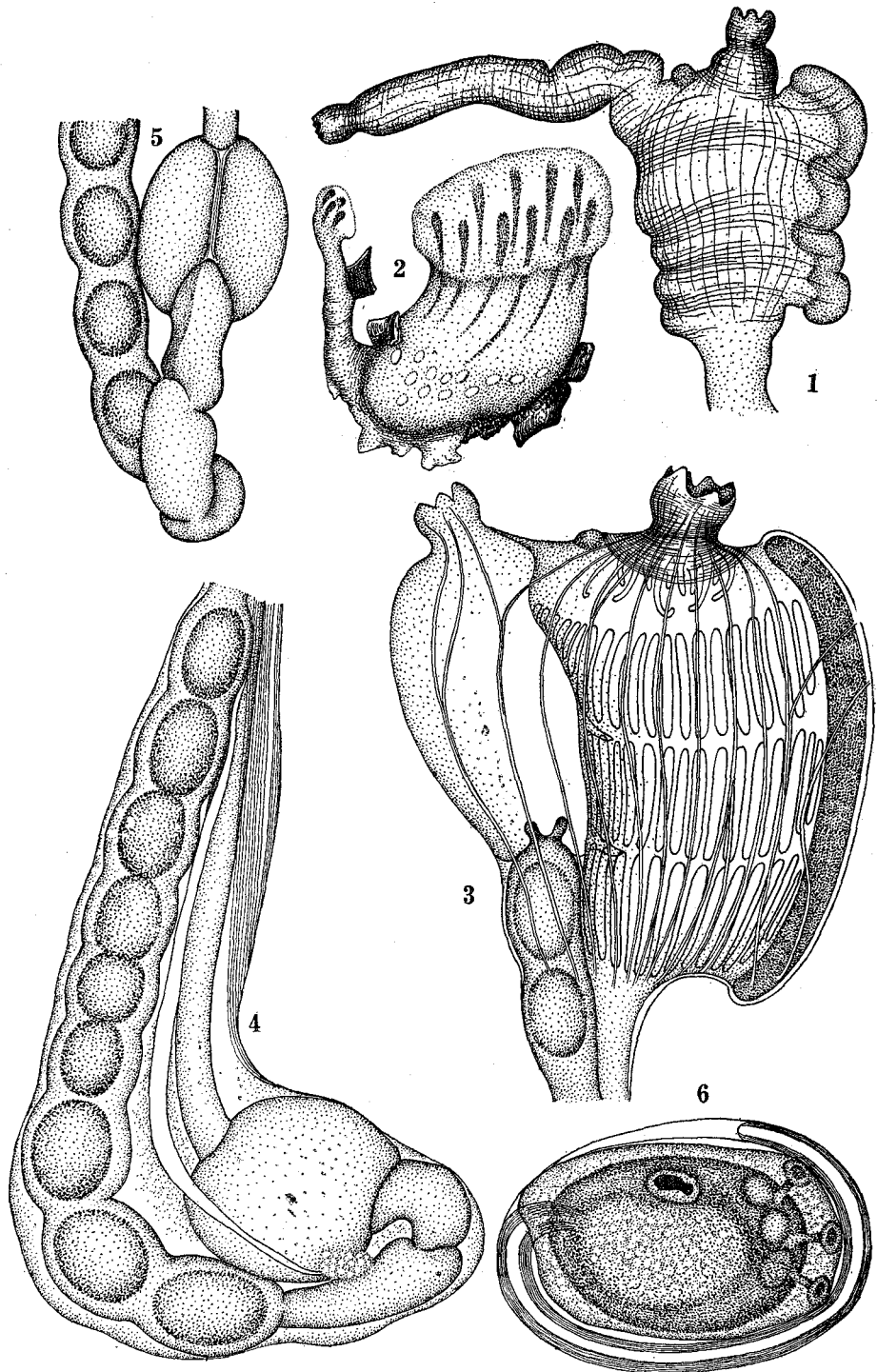
2—Colony, enlarged.

3—Thorax from right side. $\times 45$.

4—Abdomen. $\times 45$.

5—Posterior part of alimentary canal. $\times 45$.

6—Embryo from right side. $\times 75$.



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EXPLANATION OF PLATE XXIX

Figs. 1-2. *Eudistoma tokarae* n. sp.

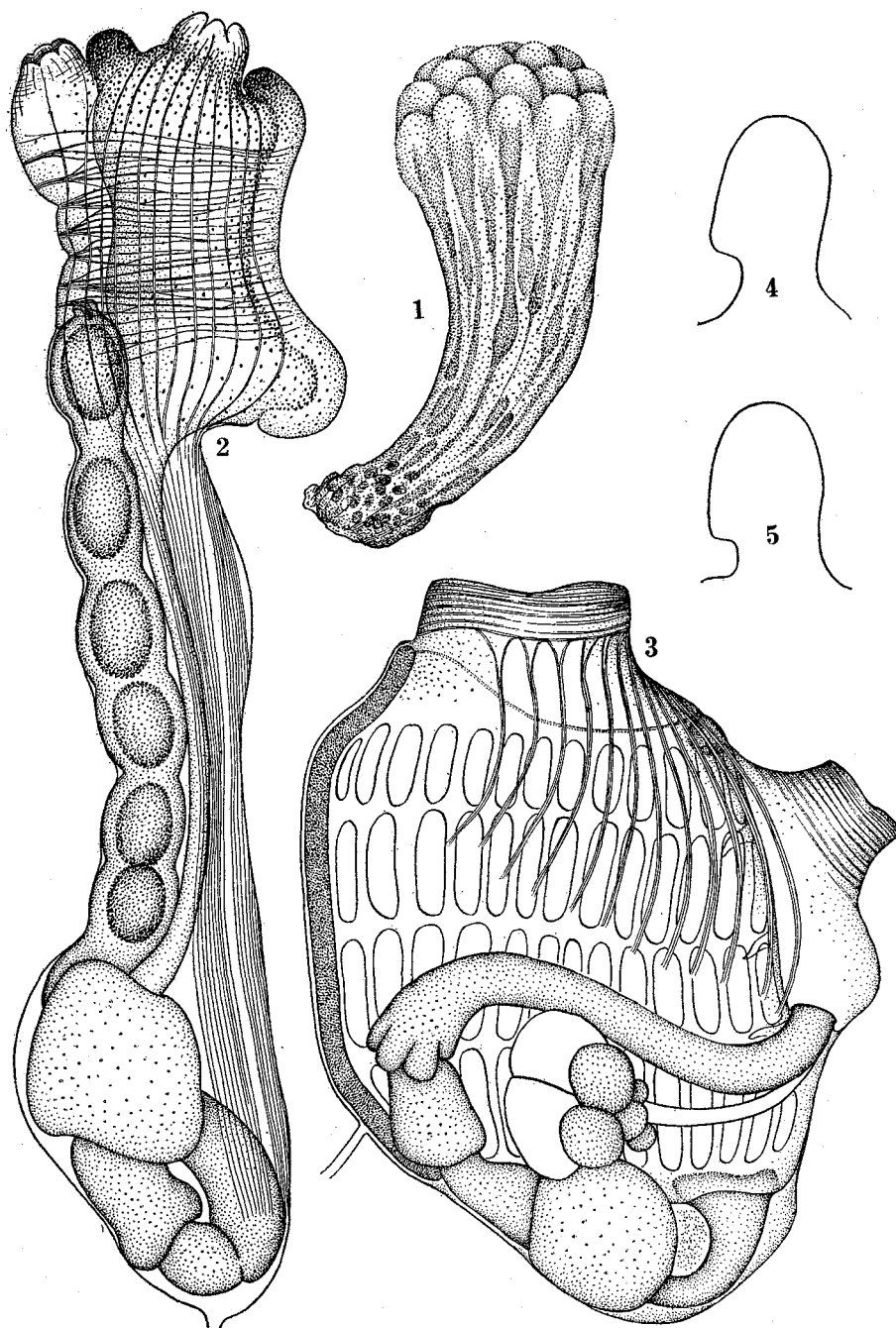
1--6 mm long colony.

2--Zoooid from right side. $\times 75$.

Figs. 3-5. *Perophora listeri* var. *tokarae* nov.

3--Mantle body from left side, magnified.

4, 5--Two of papillae supporting the inner longitudinal vessel. $\times 200$.



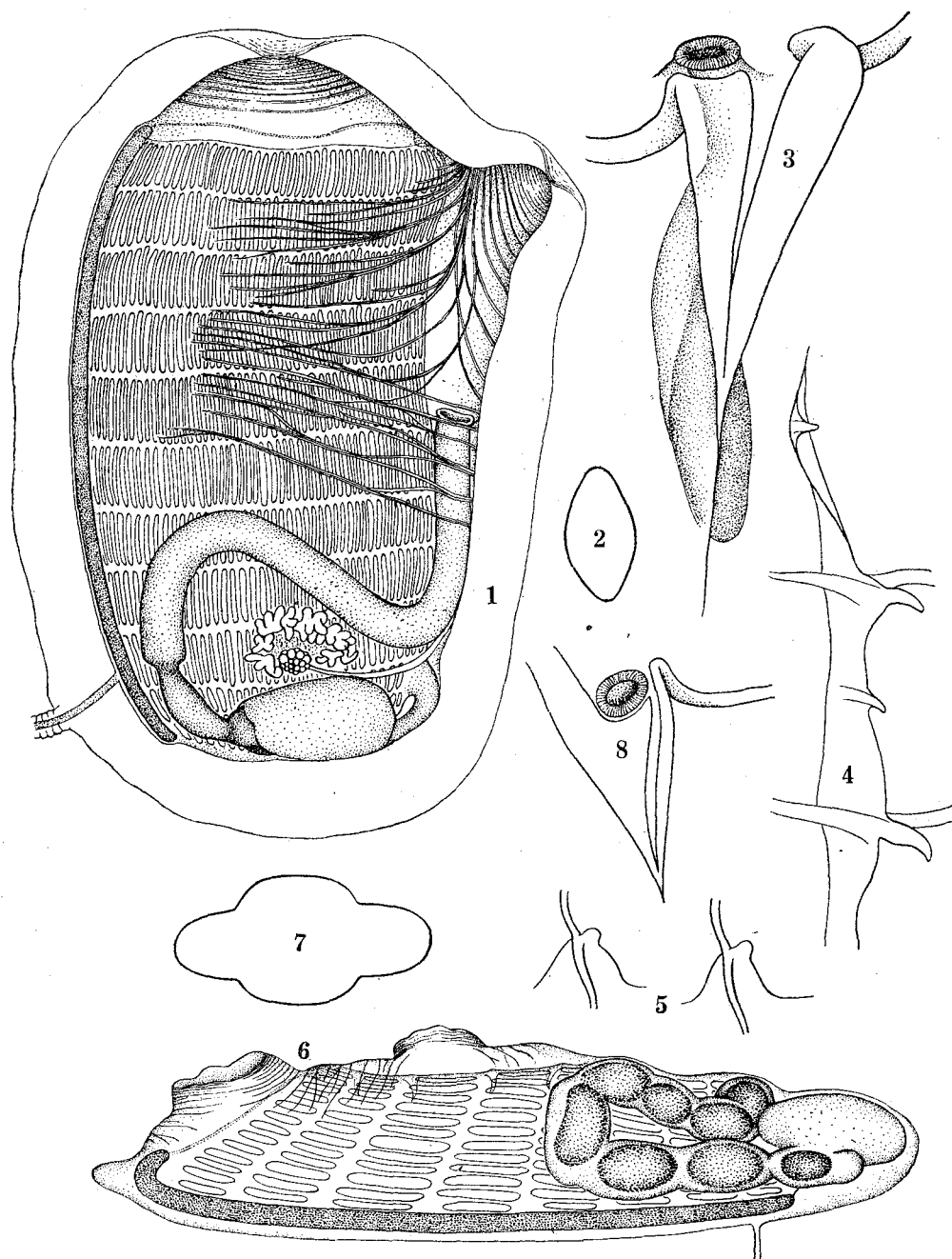
EXPLANATION OF PLATE XXX

Figs. 1-5. *Ecteinascidia tokaraensis* n. sp.

- 1—An individual from left side, enlarged.
- 2—Optical section of stomach, enlarged.
- 3—Ciliated groove and the anterior end of dorsal lamina. $\times 75$.
- 4—A part of dorsal lamina. $\times 75$.
- 5—Two of papillae supporting the inner longitudinal vessel. $\times 75$.

Figs. 6-8. *Ecteinascidia jacerens* n. sp.

- 6—An individual from left side, enlarged.
- 7—Optical section of stomach, magnified.
- 8—Ciliated groove and the anterior end of dorsal lamina, magnified.

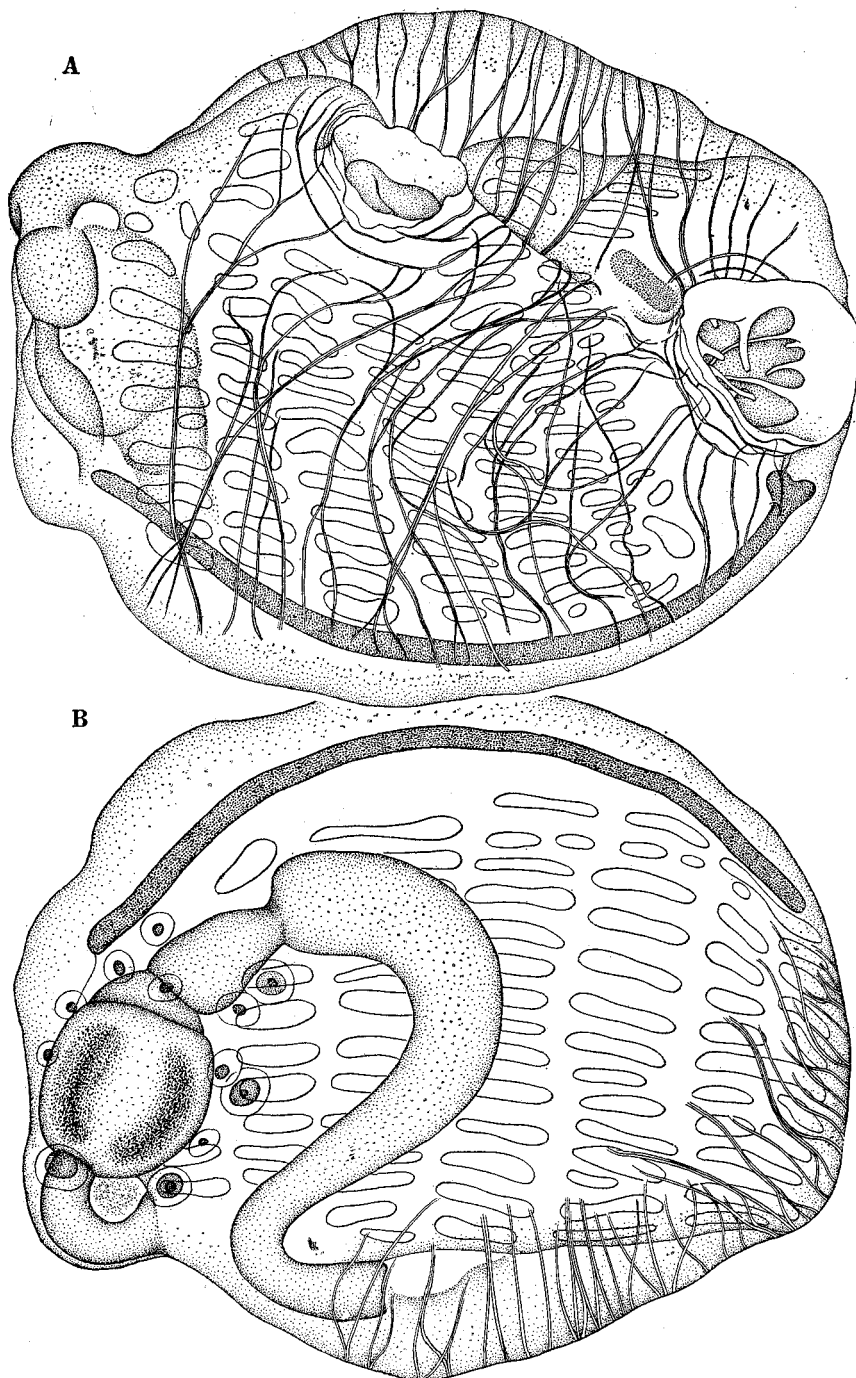


EXPLANATION OF PLATE XXXI

Figs. A-B. *Ecteinascidia jacerens* n. sp. \times ca. 60.

A—Right dorsal side.

B—Left ventral side.



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EXPLANATION OF PLATE XXXII

Fig. 1. *Ecteinascidia jacerens* n. sp. 1—Elongate stomach. $\times 75$.

Figs. 2-8. *Ascidia aperta* SLUITER

2—53 mm long and faintly coloured individual.

3—40 mm long and well coloured individual.

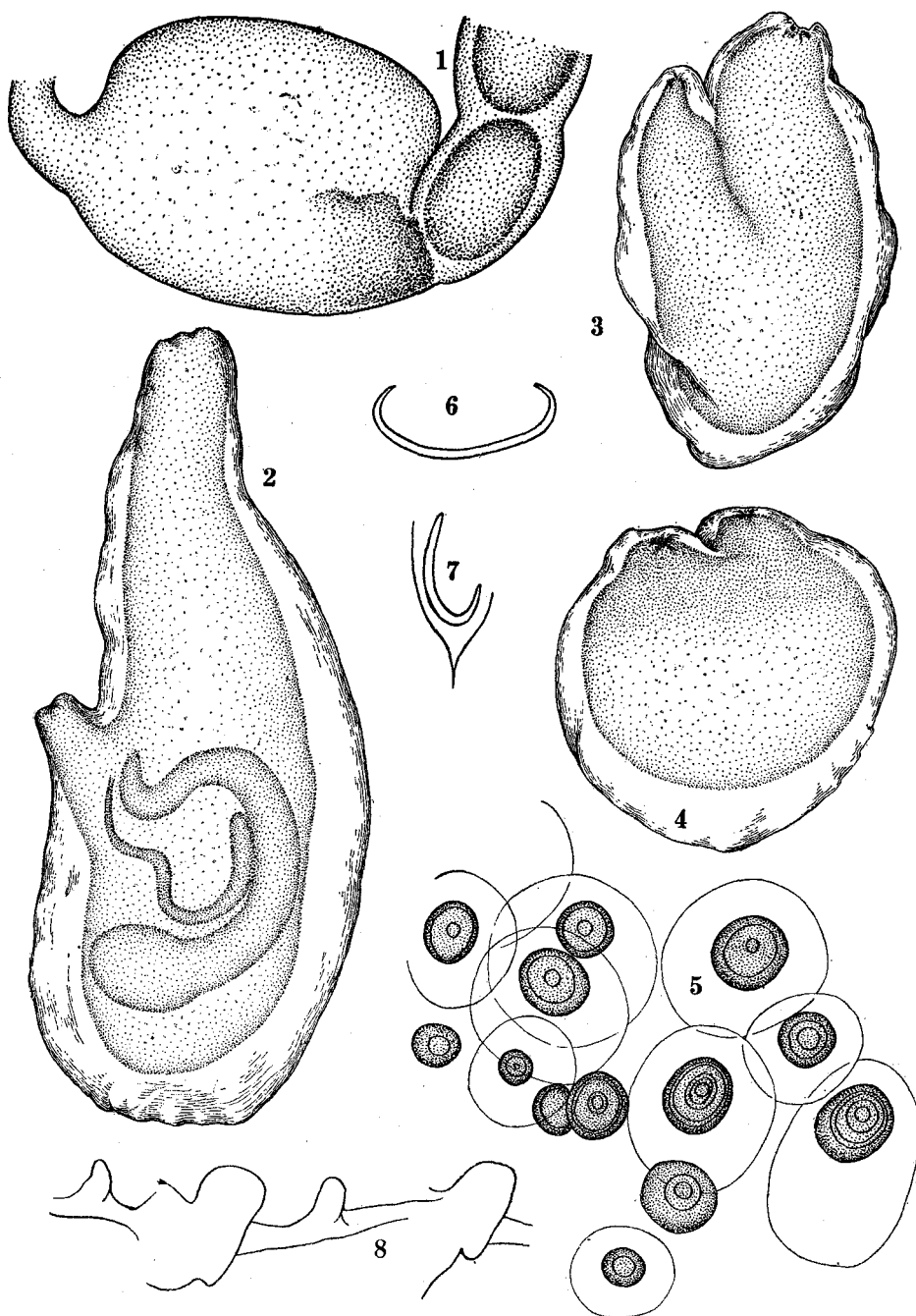
4—28 mm long and deeply coloured individual.

5—Concentric yellowish-brown bodies along the alimentary canal. $\times 75$.

6—Ciliated groove of the 53 mm long individual, magnified.

7—Ciliated groove of the 28 mm long individual, magnified.

8—Supporting papillae of the inner longitudinal vessel. $\times 75$.



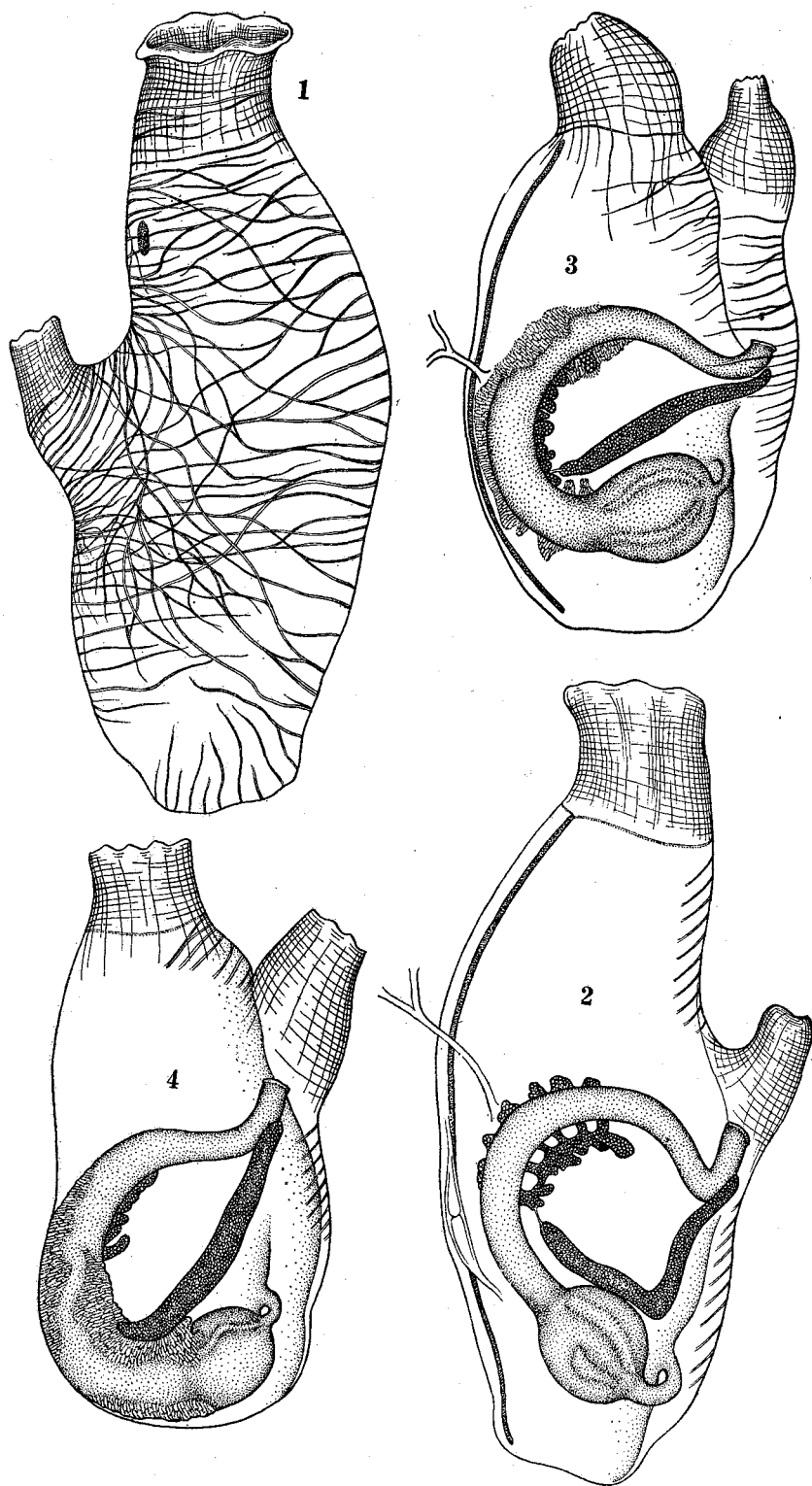
EXPLANATION OF PLATE XXXIII

Figs. 1-4. *Ascidia aperta* SLUITER

1—Mantle body of the 53 mm long individual, right side.

2—Mantle body of the 53 mm long individual, left side.

3, 4—Mantle bodies of two 40 mm long individuals, left side.



EXPLANATION OF PLATE XXXIV

Figs. 1-5. *Ascidia beta* n. sp.

1—Entire animal from right side, enlarged.

2—Mantle body from right side, enlarged.

3—Mantle body from left side, enlarged.

4—Ciliated groove, magnified.

5—Supporting papillae of the inner longitudinal vessel. $\times 200$.

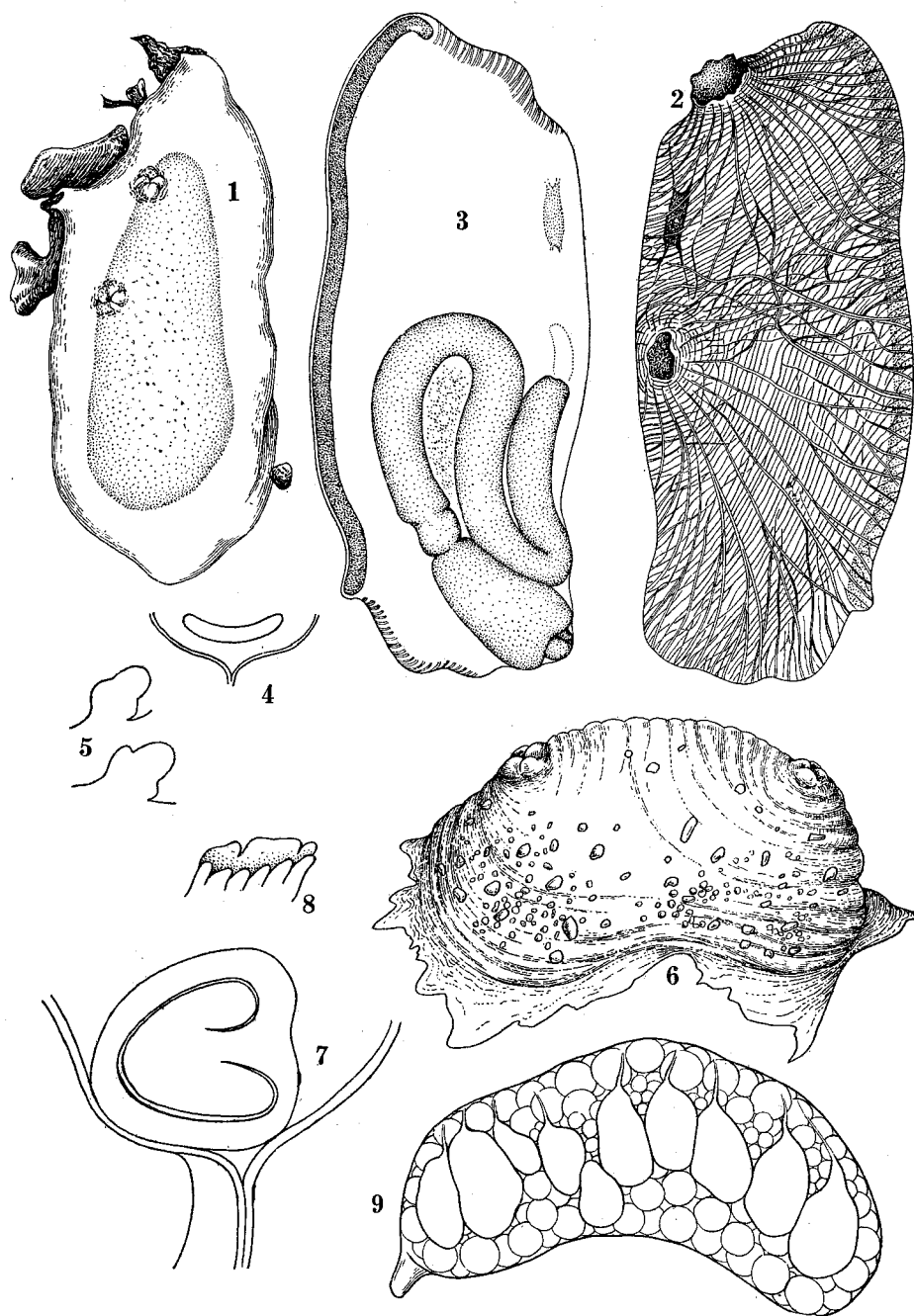
Figs. 6-9. *Polycarpa takarazima* n. sp.

6—13 mm long individual.

7—Ciliated groove, magnified.

8—Anus, magnified.

9—A gonad, side of attachment. $\times 50$.



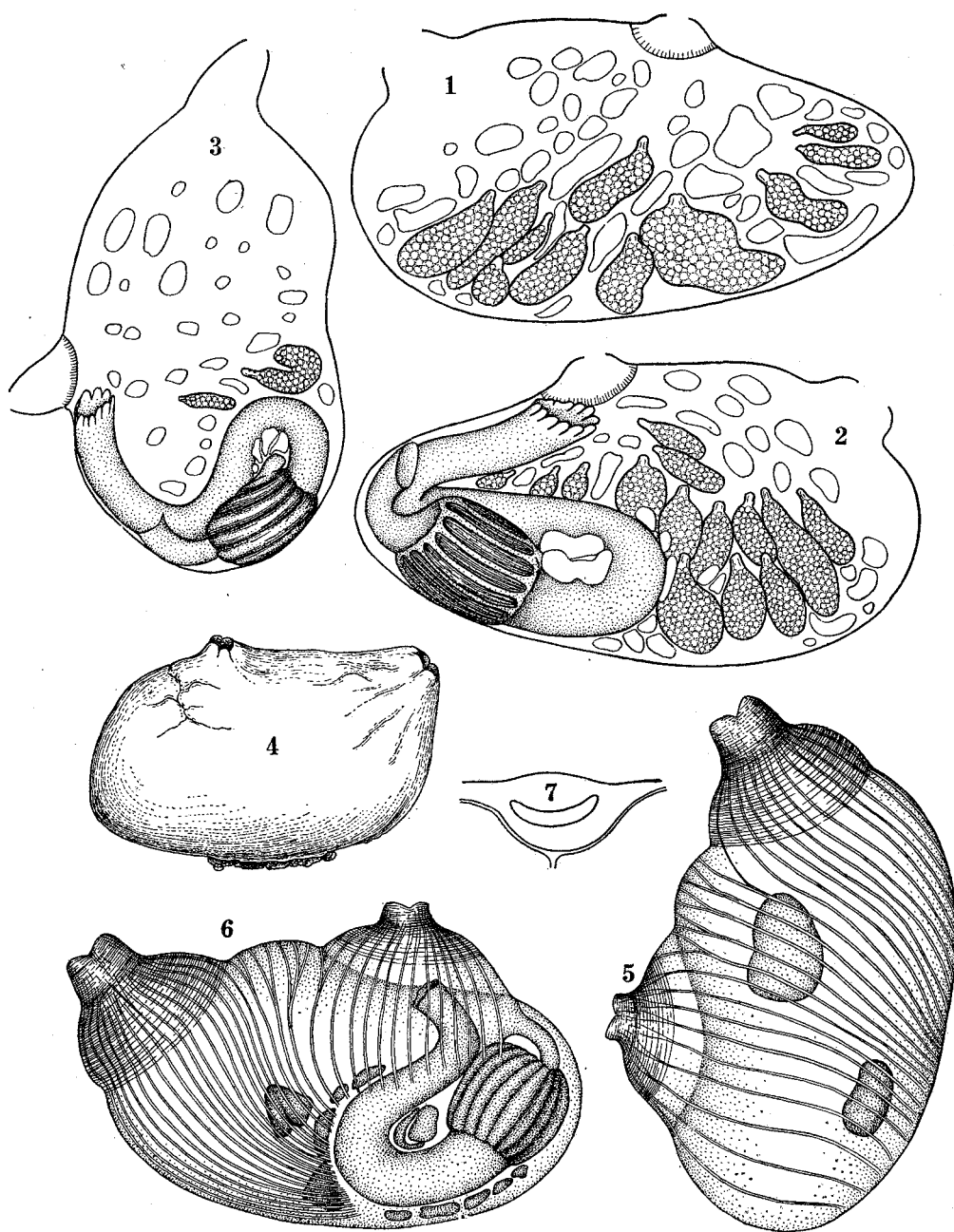
EXPLANATION OF PLATE XXXV

Figs. 1-3. *Polycarpa takarazima* n. sp.

- 1—Right half of mantle body of 13 mm long individual, inside.
- 2—Left half of mantle body of 13 mm long individual, inside.
- 3—Left half of mantle body of 12 mm long individual, inside.

Figs. 4-7. *Cnemidocarpa areolata* (HELLER)

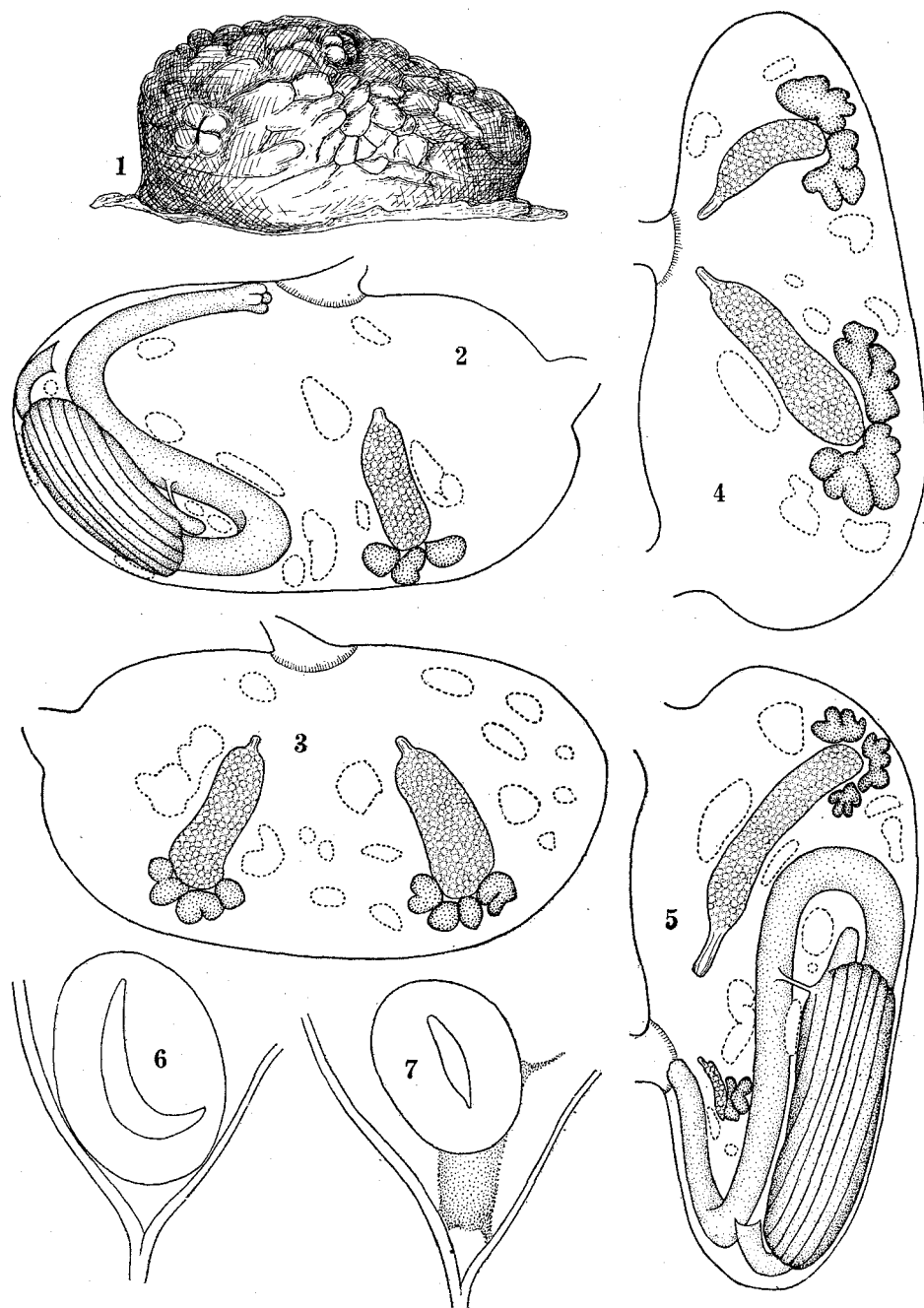
- 4—7.5 mm long individual.
- 5—Mantle body from right side.
- 6—Mantle body from left side.
- 7—Ciliated groove, magnified.



EXPLANATION OF PLATE XXXVI

Figs. 1-7. *Styela partita* (STIMPSON)

- 1—10 mm long individual.
- 2—Left half of mantle body of 10 mm long individual, inside.
- 3—Right half of mantle body of 10 mm long individual, inside.
- 4—Right half of mantle body of 9 mm long individual, inside.
- 5—Left half of mantle body of 9 mm long individual, inside.
- 6—Ciliated groove of 10 mm long individual, magnified.
- 7—Ciliated groove of 9 mm long individual, magnified.



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EXPLANATION OF PLATE XXXVII

Fig. 1. *Styela partita* (STIMPSON) 1—Larva. $\times 200$.

Figs. 2-9. *Microcosmus curvus* n. sp.

2—10 mm long individual from Takarazima, left side.

3—10 mm long individual from Nakanosima.

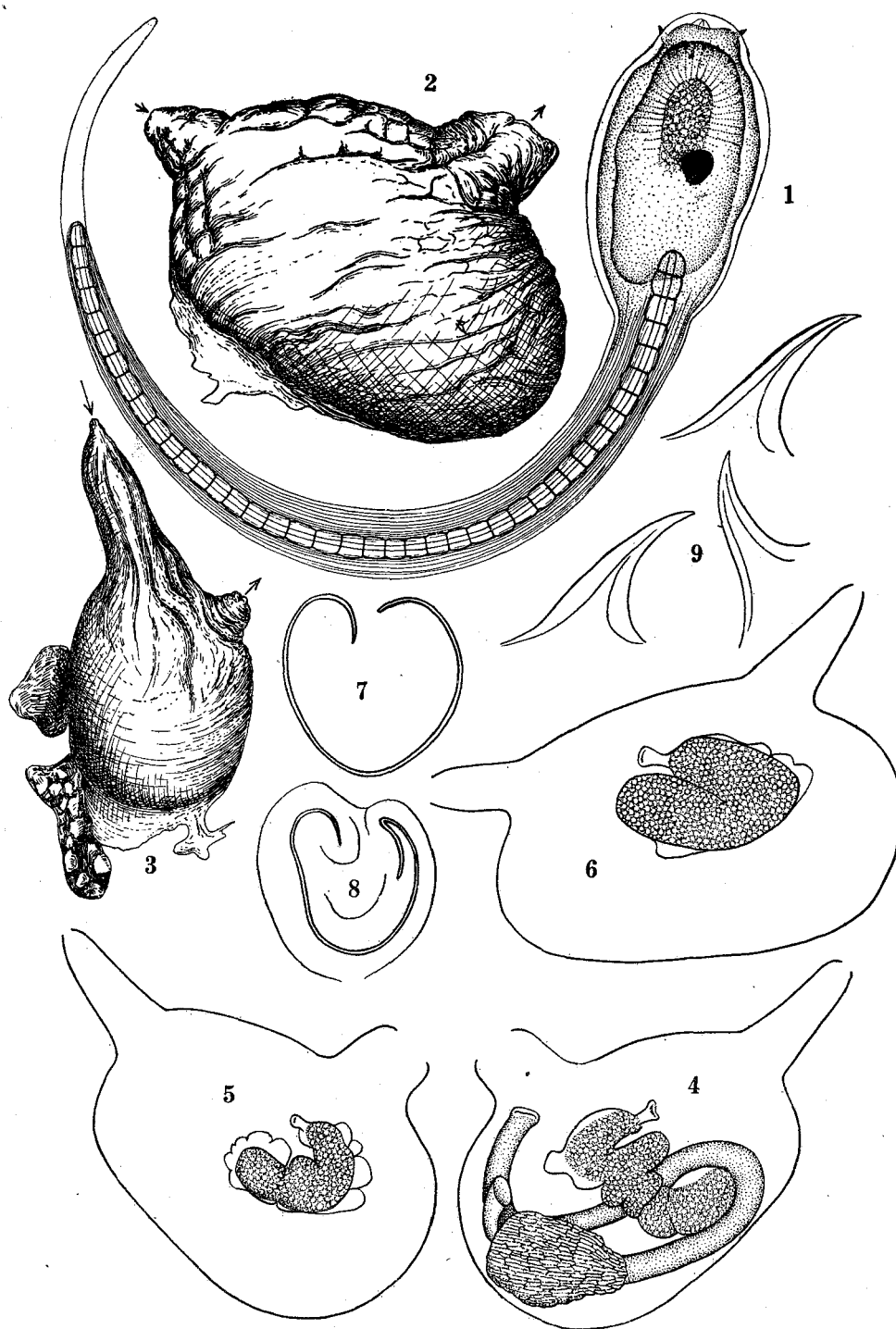
4—Left half of mantle body of individual shown in fig. 2, inside.

5—Right half of mantle body of individual shown in fig. 2, inside.

6—Right half of mantle body of 12 mm long individual, inside.

7, 8—Ciliated grooves, magnified.

9—Spinules from the distal part of stomodaeum. $\times 1200$.



CORRECTION OF IDENTIFICATION OF STOMATOPODA

Prof. T. KOMAI found out a misidentification of Stomatopoda in my paper "Invertebrate fauna of the intertidal zone of the Tokara Islands IV. Preliminary list of the collection of Brachyura and Stomatopoda" (Publ. Seto Mar. Biol. Lab., III 2, 1953). He taught me kindly that *Gonodactylus glabrous* BROOKS listed in p. 143 should be young individuals of *Gonodactylus spinosocarinatus* FUKUDA.

Gonodactylus spinosocarinatus

FUKUDA, T. (1909): Report on Japanese Stomatopoda with descriptions of two new species, Annot. Zool. Japon., Vol. 7, pp. 143-145, Pl. IV figs. 2 and 2a.

福田 卓 (1909): 日本産口脚類, 動物学雑誌, Vol. 21, No. 244, pp. 54-56, Pl. V figs. 2 and 2a.

—Takasi TOKIOKA—